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annual report

To the Congress for 1981

CONGRESS OF THE UNITED STATES
Office of Technology Assessment
Washington, D.C. 20510

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Contents

Section *Page*

I. Statements by the Chairman and Vice Chairman of the Board, TAAC Chairman, and the Director of OTA 1

II. Year in Review 9

III. Work in Progress 39

IV. Organization and Operations 61

Appendixes

A. List of Advisors and Panel Members 71

B. OTA Act—Public Law 92-484 103

Section I.—Statements by the Chairman and Vice Chairman of the Board, TAAC Chairman, and the Director of OTA

CHAIRMAN'S STATEMENT—SENATOR TED STEVENS

During 1981 the Office of Technology Assessment (OTA) provided technical analysis of a variety of topics emphasizing its role as "shared staff" to Congress. The Office released studies on issues ranging from agriculture, to MX basing, to applied genetics, in addition to conducting economic analysis of the steel, electronic, and automotive world markets.

The wide range of expertise available on the staff of OTA allows it to provide technical assistance to a diverse group of committee staffs and Senate and House offices with varying interests and needs.

Congress, like the rest of the Federal Government, is being pressed to do more with less. Congress must examine more issues with even greater scrutiny at the same time the resources available to do so become scarcer. Therefore, it is becoming increasingly important that research on complex technical questions facing Congress be coordinated among the various committees and between the two chambers.

The Office of Technology Assessment has been successful in accomplishing this goal, thus avoiding duplication of efforts. It has also been able to provide Congress with a support staff well versed in technical matters.

Congress will face a number of intricate and complicated issues this year requiring OTA's expertise and technical capabilities. I look for OTA to be involved in a number of the major issues ahead.

VICE CHAIRMAN'S STATEMENT—CONGRESSMAN MORRIS K. UDALL

OTA was established because Congress realized that technology-related issues were assuming increasing importance in congressional deliberations. In 1981, it was evident that technology was the key to dealing with a whole host of major national needs including:

- upgrading our national defense;
- reducing our dependence on foreign oil;
- conquering heart disease and cancer;
- boosting the productivity of our workers; and even
- providing an adequate supply of water to the West.

In all these areas, it is vital that Members of Congress have an adequate understanding of the hazards and potential of technology, if we are to grapple effectively with the problems. Members, of course, cannot possibly be familiar with all the latest scientific advances and their implications for public policy—thus, the need for OTA. Over the last few years in particular, OTA has compiled an impressive record of accomplishment. It has produced a virtual library of authoritative, relevant, and viable studies of some of the most perplexing problems that the Government has had to face.

It is perhaps worth recalling how difficult an assignment was given to this new agency. OTA was to be a part of Congress, overseen by a congressional board and servicing congressional committees; yet it was also to be nonpartisan, objective, and technically expert enough to command the respect of the professional scientific community. OTA's expertise was to cover the entire span of the physical, biological, and social sciences. It was not simply to analyze complex scientific and technological issues confronting Congress—a difficult enough task. OTA was to help Congress anticipate issues that were not yet on the legislative agenda. It was to assess the full range of implications of technological change—economic, technical, social, environmental, political, military, health, etc.—as appropriate. It was to do all this in a manner that would fit congressional timetables and committee jurisdictions. This is a very tall order, indeed. What is remarkable is the extent to which OTA is now fulfilling its mandate.

I look forward to working with Chairman Ted Stevens in building on this record of accomplishment in the year ahead.

TAAC CHAIRMAN'S STATEMENT—CHARLES N. KIMBALL

A major function of OTA is the transfer of technical knowledge from the scientific community to Congress. This is a vital and complex task. No person, even with advanced technical training, can hope to keep abreast of the significant advances in science and technology which have implications for public policy. If Congress is to continue to fulfill its responsibilities to lead this Nation, it must have accurate access to the issues presented by scientific and technological change.

OTA performs this role and performs it well. In addition to its own competent staff it draws on experts in the corporate, university, and public sector communities through project advisory panels, workshops, consultants, reviewers, and contractors. The result is a uniquely comprehensive network of expertise available to help Congress deal with issues as complex and different as, for example, nuclear waste disposal or the international competitiveness of the U.S. electronics industry.

Such technology also flows the other way. OTA reports have become highly valued in the private sector for their authority and utility. Issues that are of concern to Congress are also of wide interest outside the Federal Government. The extensive sale through the Government Printing Office and commercial reprinting of OTA reports is but one indicator of how valuable this agency has become both to Congress and to society as a whole.

DIRECTOR'S STATEMENT—JOHN H. GIBBONS

Some Highlights of 1981

The range of services to Congress provided by OTA during 1981 reflects its broad charter to provide Congress with analyses of the implications—direct and indirect—of science and technology for current legislative issues as well as long-term national problems. A few highlights are given in the following paragraphs. A more complete accounting of OTA's products and services is provided later in this report.

- OTA was asked to provide Congress with an assessment of options for *MX Missile Basing*. A wide variety of basing schemes was identified and systematically compared to disclose the several advantages and disadvantages associated with each. Projections were made of both the Soviet threat and foreseeable improvements in U.S. technology for the time period when MX would be operational. The resulting comparison showed that all available basing options have one or more serious drawbacks. This work was widely used in the legislative and executive branches during the year and promises to have continuing value.
- OTA also provided Congress with a comprehensive analysis of *Impacts of Applied Genetics*. This rapidly moving field promises to be a major source of technological advances in the 1980's in such diverse areas as health, agriculture, chemicals production, and waste management. OTA concluded that current self-imposed safety regulations by researchers and producers seem appropriate; that the current U.S. lead in applied genetics technologies is threatened by vigorous foreign competition; and that new institutional arrangements, especially between universities and industry, are going to be important to the successful application of these new technologies. In contrast to the MX study, OTA's assessment on genetics was mostly oriented toward foresight rather than current legislative issues. The Government Printing Office reported particularly high sales of this report. It has also been published by the commercial U.S. press and was a featured selection in the recent offerings of the Library of Science book club. The report has also been published in England and now is being translated and printed in Japan by a commercial publisher.
- Legislative issues are proliferating with respect to the direct and indirect roles of Government in innovation and international competitiveness. In 1981, OTA completed several studies relevant to these issues. For example, a comparison of international competitiveness in the steel, auto, and electronics industries found that a "macroindustrial" Federal policy would have a number of advantages over the present collection of ad hoc and sometimes contradictory, industrial policies (*U.S. Industrial Competitiveness: A Comparison of Steel, Electronics, and Automobiles,* July 1981). An OTA analysis of

coal exports and implications for U.S. port development highlighted the major opportunities to expand U.S. coal exports, the capabilities and problems of present deep water ports, and impacts of user-based fees as partial means of financing port development (*Coal Ports and Port Development*, April 1981).

- Energy issues remain a matter of major concern. During the year, OTA published an assessment of the prospects for *Solar Power Satellites;* an analysis of alternative schemes for *Nuclear Powerplant Standardization;* and a definitive study of *Technology and Soviet Energy Availability*. Several major points emerge from these and earlier OTA energy projects. First, even though demand for oil and gas is rising more slowly than it was (due both to price increases and recession) the difficulty of providing incremental gains in output—or even holding on to current production rates—is increasing, and the margin between current U.S. demand and relatively secure supply is still far from comfortable. Second, sharply higher prices have not resulted in a significantly expanded supply of these premium fuels. In contrast, response to price increases has been remarkably elastic on the demand side as various technologies are used to provide for more efficient use of energy. Third, several promising options exist to obtain more assured safety and performance in nuclear power reactors by means of standardization. One proposed alternative, electricity from orbiting solar power satellites, appears to be unacceptably expensive even under optimistic assumptions. Lastly, while the U.S.S.R. faces level or declining oil production beginning in the latter half of the 1980's, their natural gas production can offset this effect, leaving them with continuing capability to supply domestic needs and to export energy (e.g., gas to Western Europe) for badly needed hard currency.

- OTA's first report on the microelectronic revolution was completed in 1981. *Computer-Based National Information Systems: Technology and Public Policy Issues*, an overview study, analyzes potential societal benefits and impacts of the new information systems made possible by advances in computer and communication technology. The growing role of information processing in U.S. society, particularly in the economy, is examined. The report explores a number of potential policy issues that Congress may need to deal with over the next decade—among them innovation and productivity, privacy, system security, vulnerability, and Federal use.

- Issues of health and safety have also been highly visible over the past year. The 1981 OTA *Assessment of Technologies for Determining Cancer Risks From the Environment* describes and analyzes cancer rates and trends, factors that are associated with cancer occurrence, methods to detect and identify carcinogenic substances, and procedures for estimating levels of human risk from such substances. It also examines the Federal laws that provide for regulations to reduce cancer risks. The report resulted in requests for testimony about subjects as varied as health risks from toxic dumps, replacements for animal tests as methods to identify carcinogens, and possible changes in food safety laws. Further, OTA's discussion of risk assessment is now being incorporated into a National Academy of Sciences study about suggested changes in the process used by the Federal Government to assess risk.

- OTA, as required by Public Law 96-151, must approve the protocol for a Veterans Administration study of possible long-term health effects resulting from exposure to *Agent Orange* in Vietnam. A draft protocol for the VA study, in September 1981, was found by OTA to be lacking in detail. The VA has returned the draft protocol to the contractor that developed it and asked for a revision.
- Additional aspects of health that continue to be of prominent congressional policy concern are the cost of health care and the relationship between the benefits of specific medical technologies and their costs. Several of OTA's health studies are directly related to these concerns. Fifteen case studies of the costs and benefits of specific medical interventions were issued during 1981, covering such technologies as automated chemistry analyzers, neonatal intensive care, screening for colon cancer and cervical cancer, nurse practitioners, cimetidine, and gastrointestinal endoscopy. These case studies were prepared as part of a larger project on the feasibility and implications of using cost-effectiveness and cost-benefit analysis in health care. A separate study of the *Cost-Effectiveness Analysis of Inactivated Influenza Vaccine*, completed during the year, examined the effects on life expectancy and the decreases in illness and in health care costs that might result from increased numbers of vaccinations.

New Challenges for OTA

During the coming decade, the United States will face problems whose solution will require the power of human inventiveness, nurtured by an economic system that encourages innovation and productive risk-taking. The opportunities for science and technology to improve the national economy, defense, health, and environment are many. The benefits do not come without costs. OTA's job is to help Congress understand the extent of the opportunities and the potential costs and evaluate alternative approaches to reduce the risks and undesired effects.

In past years, when inflation was lower and public investment for research and development was more readily available, the Nation could often afford to follow many promising paths simultaneously. Now, with mounting pressures to cut Government expenditures, more difficult choices have to be made, including not funding some admittedly very promising ideas. This new imperative means that careful analysis of options is more important than ever because the potential cost of being even a "little wrong" can be so high. Facts must be sorted out, informed consensus must be sought, and accurate, timely, unbiased information must be available to Congress on a growing list of complex, costly, and controversial issues. OTA carries out these tasks, acting as a shared resource for committees of the House and Senate. In performing its analytical work for Congress, OTA links and synthesizes the collective expertise from all sectors of the United States. Each year roughly 2,000 people from universities, private corporations, State and local government, and Federal agencies assist OTA in its assessment work. In this manner, OTA avoids duplication of existing work and acts as a catalyst to bring national wisdom to bear on congressional issues.

In 1981, OTA worked on more than 30 assessments that, because of their scope and depth, typically require 1 to 2 years to complete. Work on the formal reports was accompanied by interim analytical papers and briefings, delivery of testimony in congressional hearings based on current and past assessments, and technical memoranda. Numerous discussions were held with senior analysts and policymakers, including officials from other nations who sought out OTA for advice and counsel. An internal review was made of the methods of assessment and analysis being used not only at OTA but in other institutions, including private industry.

A Glimpse Ahead

Satchel Paige once expressed his philosophy of life as ". . . Don't look back; something might be gaining on you . . . !" Despite that admonition, we feel that it is essential both to look backward *and* forward in order to properly understand the present and to prepare for the future. OTA has this dual responsibility. What, then, do we see ahead?

A year ago I wrote of molecular biology and microelectronics as typifying the advanced areas of science and technology which will deeply impact our personal and national life. I wrote of international and global impacts of human activity that constitute our growing interdependence.

It is easy to be pessimistic. Each year the technological capability of nations to do violence grows. Can mankind use its technological ingenuity to lessen the danger of conflict? Many nations are mortgaging their future by virtue of providing goods and services at a rate that is not sustainable over time. What are our options to build a long-term sustainable world economy? In the past, dire outlooks for the future have more often than not been diverted by the exercise of human inventiveness through technology. What new options can technology offer to turn the tide? What are our best options to assure adequate energy and other resources for the United States? How can we best assist other nations in their struggle for economic growth? To what extent can we provide a high material standard of living while maintaining a high standard of environmental quality? Our hope for future success lies ". . . not in our stars but in ourselves . . ." (apologies to Shakespeare's Mark Antony)—i.e., in the unfathomed potential of human inventiveness.

Our best hopes for the future, once focused on the seemingly infinite West and on rich natural resources, now lie substantially in the esoteric world of nuclei, atoms, molecules—a microscopic world of crystal lattices, big molecules, and quantum theory. This microrealm is a world that few people are presently privileged to understand even superficially, and yet all are affected deeply by the technologies that emerge from it.

The increasing gulf between accelerating developments of scientific and technological knowledge on the one hand and the level of scientific literacy of our citizens on the other creates a need for dispassionate analysis and information transfer. OTA's job in this context is to continue to show that complex and controversial issues can be subjected to analysis that is accurate, understandable, and useful to Congress. Such analysis is the necessary foundation on which effective national policy can be built.

Section II.—Year in Review

The assessments carried out by OTA cover a wide spectrum of major issues before Congress and the country. They examine a broad range of policy options and their potential impacts. To provide examples of the breadth and depth of OTA's work, summaries of reports published by the Office in 1981 are presented in this section. Also included are summaries of Background Papers and Technical Memoranda issued by OTA on specific subjects analyzed in recent OTA reports or on projects in progress at OTA. Background Papers and Technical Memoranda are neither reviewed nor approved by the Technology Assessment Board.

The reader is cautioned that these are summaries of reports. They do not cover the full range of options considered or all of the findings presented in any individual report.

Technology for Local Development

Appropriate technology (AT) has been proposed by some as a solution to many of the social and economic problems created by large-scale, centralized technology. Ideally, AT emphasizes small-scale, energy efficiency, environmental soundness, community control, labor (rather than capital) intensiveness, and local resources.

An Assessment of
Technology
for Local
Development

The AT projects examined in OTA's exploratory study exhibit a great diversity in size, complexity, and location. They range from attached solar greenhouses in New Mexico to a plant that converts municipal waste to steam heat in Akron, Ohio; from a heat-retentive house designed for low-income families in Alaska to a cooperative farmers' market in Louisiana; and from an innovative wastewater treatment plant in California to small-scale hydroelectric dams in New England.

These AT projects were generally successful in achieving local goals and involving local residents in the planning, construction, and management of their facilities. Several projects provided marketable training and work experience, and others improved the viability of existing local enterprises, notably the small family farm.

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At the community level, these technologies promise considerable benefits in three substantive areas: 1) improving the delivery and reducing or stabilizing the cost of community services; 2) improving the profitability of small-scale agriculture; and 3) improving energy efficiency.

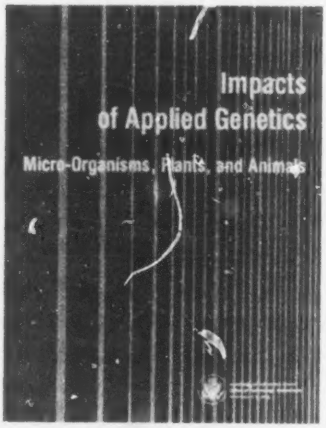
If these and similar projects are widely replicated, they could lead to significant benefits on the national level, including:

- energy conservation in the residential sector, which currently accounts for over 20 percent of U.S. consumption;
- lower production costs and more profitable marketing techniques for small-scale farmers, which might help to slow the conversion of the Nation's farmlands to nonagricultural uses;
- lower costs and greater flexibility in upgrading the Nation's sewage treatment facilities, whose costs might otherwise be beyond the available resources of Federal, State, and local governments;
- increased generating capacity at abandoned or underused damsites, which could substantially increase the Nation's supply of hydroelectric power; and
- significant savings or improved delivery in community health care services.

Many existing Federal policies and programs have been relatively successful in encouraging the development and adoption of AT projects like those examined. On the basis of these case studies, there appears to be no need for new legislation or major increased Federal involvement, though existing programs could be made more effective in four specific areas: 1) gathering reliable data on the design, cost, and performance of the technologies; 2) disseminating this information through regional demonstration projects and through the encouragement of local networking; 3) technical assistance, including community workshops for individuals and planning aids for municipalities; and 4) financial assistance, such as tax credits or cost-sharing for individuals and risk guarantees or tax-free financing for municipalities.

These case studies suggest that individuality, ingenuity, and local initiative are far from lacking in the United States.

Impacts of Applied Genetics; Micro-Organisms, Plants, and Animals



New genetic technologies developed in the last 10 years will have a major commercial impact on the pharmaceutical, chemical, and food processing industries, probably in that order. These technologies, already in use in several industries, offer fresh approaches to filling basic needs such as health care, and food and energy supply. At the same time, they arouse concerns about possible risks to health and the environment and the effects on human values.

Genetic technologies open up new possibilities for developing vaccines for such intractable diseases as hepatitis and malaria. The availability of any one of these vaccines would improve the lives of tens of millions of people. Other pharmaceutical products likely to be affected in the next 10 to 20 years are most antibiotics, enzymes, antibodies, and many hormones.

The economic impact of genetic technologies on the chemical industry within the next 20 years is estimated at billions of dollars per year and cuts across the entire spectrum of chemical groups. These include plastic and resin materials, synthetic rubber, pesticides, and the primary products from petroleum that serve as the raw materials for the synthesis of organic chemicals.

Large-scale availability of enzymes, made possible through genetic technologies, will play an increasing role in the food processing industry. Genetic techniques can transform inedible biomass into food for humans or animals and otherwise aid in the processing of food.

The application of genetic technologies to plants, combined with classical breeding methods, offers the promise of increased yield, resistance to disease, and improved nutritional value. Genetic technologies will probably not be used directly to affect animal production and products within the next 10 years. However, applications in the production of animal vaccines and hormones will likely be significant within that period.

Genetically engineered micro-organisms may be developed for use in three areas that require their large-scale release into the environment: oil recovery, pollution control, and mineral leaching. Technical constraints and questions about potential effects on human health and the environment are a major obstacle to their use.

No evidence exists that any unexpected harmful genetically engineered organism has been created. Still, few experts believe that molecular genetic techniques are totally without risk to health and the en-

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vironment. National Institutes of Health guidelines and current Federal laws appear adequate in most cases to deal with any risks. However, there is uncertainty about the regulation of production methods using engineered micro-organisms or their intentional release into the environment for those cases where the risk is not clear.

Last year's Supreme Court decision to allow human-tailored organisms to be patented will stimulate their commercial use. However, the option left room for Congress to overrule the decision, develop a comprehensive statutory approach, and decide which organisms, if any, should be patentable.

Current industry activity in genetics indicates that sufficient capital is available for specific production objectives. But some high-risk or low-profit areas of interest to society, such as pollution control or enhanced oil recovery, may need Government promotion if they are to be developed.

Nuclear Powerplant Standardization

Standardization of nuclear powerplants can be an essential element in maintaining a viable and safe program for nuclear energy. Virtually all of the existing 71 U.S. nuclear powerplants were uniquely designed and engineered by many different companies under changing regulatory demands, utility desires, and industrial standards. Navy reactors have been more nearly standardized, but this experience is not directly applicable to commercial powerplants. Therefore, there is no experience that explicitly proves that standardizing reactors would improve public safety. Nevertheless, the belief that safety benefits would result is intuitively valid and widely accepted by experts including the nuclear industry.

Nuclear Powerplant Standardization
Light Water Reactors

Some of the advantages of reducing diversity via standardization are that designers and safety analysts could better focus their efforts on perfecting existing designs; the licensing process could be stabilized; and the process for evaluating and implementing safety modifications for operating plants could be improved.

There has already been a significant consolidation of designs by each company involved. This trend would be greatly accelerated by single-stage licensing. Utilities could then order plants with preapproved designs and would have to get only site-specific features licensed. The Nuclear Regulatory Commission (NRC) could unilaterally implement single-stage licensing, but this change would be accelerated by congressional encouragement.

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Another approach to standardization would be to have utilities use common procedures and terminology to facilitate information transfer among plants. The adoption of uniform reporting practices and industrywide participation in review of operating experience would improve the dissemination of relevant safety and reliability information.

Standardization could involve the reactor and its associated safety systems (the "safety-block" concept) or even the entire plant. Such standardization would, to some extent, impose designs on companies that had not developed them. This commonality would eventually provide significant safety and licensing benefits. However, it would also disrupt the commercial industry causing problems which may outweigh these benefits. Congressional action would probably be necessary if these levels of standardization are desired.

Rapidly changing and uncertain safety regulations have been major impediments to standardization. A national safety goal for nuclear powerplants would greatly alleviate this problem. Debate and adoption of a quantitative definition of "how safe is safe enough" would provide a benchmark for determining the necessity for design changes.

Currently there is a lack of orders for new plants due to both lower growth in electricity use and lack of confidence by utilities in the licensing process. Standardization can significantly assist in restoring that confidence. However, NRC is currently devoting little time to standardization.

Standardization has clear potential for time and cost reductions and for gains in safety for new nuclear powerplants. At the same time, standardization is not a panacea and the other elements needed for a safe and efficient nuclear program should not be ignored.

U.S. Industrial Competitiveness: A Comparison of Steel, Electronics, and Automobiles

A reorientation of Federal industrial policy could help the performance of the U.S. economy. Government policies that affect the international competitiveness of American industry—including those dealing with trade, taxes, technology, and regulation—suffer from fragmentation and lack of continuity. This puts U.S. industry at a disadvantage compared to several of our international rivals. There are no "quick fixes" to problems of economic efficiency and productivity, but unless the Government takes positive action, U.S. competitiveness will probably continue to deteriorate.

U.S. Industrial Competitiveness
A Comparison of Steel, Electronics, and Automobiles

Although the causes differ, U.S. competitiveness in steel, electronics, and automobiles has in fact declined. Steelmakers are still closing facilities, steelworkers losing their jobs. Many of the TV sets—and all of the home video recorders—sold in the United States are now imported. In 1980, as American automobile firms lost more than $4 billion, imports from Japan continued to rise.

In steel, productivity has not grown fast enough to offset rising wage levels. Public policies have not directly addressed modernization and productivity improvement.

Even in high technology portions of the electronics industry—such as computers and semiconductors—domestic firms have been unable to maintain the technological advantages on which their leadership in world markets depends. Government policies in support of R&D and innovation have had only limited positive effects on high technology industries—although the future strength of the U.S. economy depends on their continued success.

The automobile market in the United States has turned away from the larger cars that have been the heart of the domestic industry. The suddenness of this shift, which caught American automakers by surprise, was caused in part by Government policies that kept gasoline cheap and plentiful during the mid-1970's.

In all three industries, the conditions of international trade and competition are changing, with overseas rivals getting stronger.

Improving productivity, economic efficiency, and competitiveness have seldom been conscious objectives of Government policymakers. Such objectives cut across the jurisdictions of many congressional committees. Fashioning a more coherent industrial policy may require that Congress create a new institutional focus such as a select committee or task force. That new focus would enable Congress to ex-

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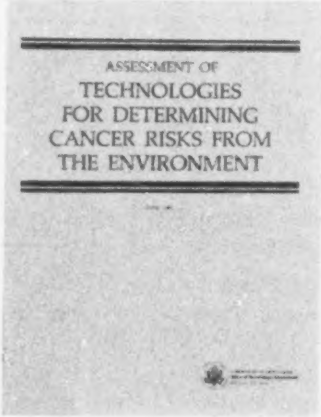
plicitly consider the impacts of particular policies on the competitiveness of U.S. industries. Such policies include: taxes, for example, modified depreciation schedules for industrial plant and equipment; regulation, such as automobiles standard-setting; technology, for instance, Government funding supporting the education and training of engineers and scientists; and trade—e.g., export financing and export trading companies.

Moving toward a more consciously developed industrial policy does not imply Government picking "winners" and "losers" or relying on aid or support for certain sectors or firms. It does imply a broad redirection of policies affecting technology and innovation; savings and capitol investment; regulation, education, training, and economic adjustment; and international trade. Such an approach—which OTA terms "macroindustrial policy"—could help to maintain and strengthen U.S. competitiveness, increase employment opportunities and living standards, and moderate inflation.

Cancer Risks From the Environment

Environment factors have contributed to as much as 90 percent of recent cancer, according to estimates made in the last two decades. The "environment," by definition, includes all influences except inborn genetic factors, and represents cancer causes that are, at least theoretically, modifiable. At present, however, specific factors are associated with less than half of all cancers.


ASSESSMENT OF
TECHNOLOGIES
FOR DETERMINING
CANCER RISKS FROM
THE ENVIRONMENT

Cigarette smoking is the cause of more cancer than any other known environmental agent. Occupational exposure to asbestos and some chemicals, some medical drugs, alcohol consumption, and exposure to radiation also cause significant but smaller proportions of the total cancer burden. Diet is associated with a large fraction of cancer, but little is known about the mechanisms involved. Major natural components of food, such as fat, are considered more important than additives and contaminants. Viruses, aspects of sexual and reproductive behavior, air and water pollution, and consumer products are linked to some cancers.

During the last half century, lung cancer mortality has increased dramatically in all races and sexes, accounting for all but a small part of the overall cancer mortality increase. Changes in mortality from cancer at other body sites have been smaller; some rising and some falling. Rates are higher and trends less favorable for blacks than for whites.

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Epidemiologic methods are used to link cancers with exposures and behaviors that, in many cases, took place decades earlier. Because of such long-delayed effects, epidemiology cannot be used to predict whether newly introduced exposures of lifestyle changes will cause cancer. The public health goal of disease prevention and congressional mandates to reduce existing exposures and to protect against new hazards necessitate using laboratory methods to identify carcinogens.

The search for less expensive, quicker replacements for animal tests, which are accepted as predictive of human risk, but cost up to $1 million and 5 years to complete, has produced more than 100 different "short-term" tests. Certain of these tests are now used by industry for screening new chemicals, but no one test nor any known combination of tests is accepted as a substitute for animal tests. The use of short-term tests as a basis for regulation faces stern opposition, and is, at best, some years off.

Extrapolation methods have been developed to project estimates of human risk from laboratory results. The Federal Government uses an extrapolation model that attaches a higher risk to a given exposure level than do most other models. Some critics contend that it overestimates risk. At present, given limited scientific agreement, the choice of a model is a policy decision.

About 100 substances have been regulated as carcinogens under laws providing for reductions in carcinogenic exposures. However, uncertainties accompanying test data and risk estimates, as well as questions about benefits associated with some carcinogens, complicate regulatory decisionmaking.

Congressional issues include: gathering information about the occurrence of cancer; the distribution of carcinogenic risks; testing for carcinogenicity; and changes in the process used to make technical decisions for regulatory purposes.

MX Missile Basing

MX Missile Basing

Five different basing modes for the MX missile appear to offer the prospect of providing survivability and meeting established performance criteria for intercontinental ballistic missiles (ICBMs). These are: multiple protective shelter (MPS) basing; MPS basing defended by a low-altitude antiballistic missile (ABM) system called LoADS; basing MX missiles in silos and relying on launching them before they could be destroyed by a Soviet attack (launch under attack, or LUA); basing MX on small submarines; and air mobile basing in which MX missiles would be ejected from widebodied aircraft and launched in midair. But each of these alternatives has serious risks and drawbacks, and no basing mode is likely to provide a substantial number of survivable MX missiles much before 1990.

MPS basing would preserve the characteristics and improve the capabilities of present land-based ICBMs. The survivability of MX/MPS would depend on successfully concealing the location of a few hundred missiles among thousands of shelters. Confidence in the United States' ability to do this will be limited until prototypes have been tested; if the Soviets elected to continue to increase their inventory of warheads through the 1980's, more missiles and shelters would have to be added to the Carter administration's proposed "baseline" MPS system of 200 missiles and 4,600 shelters to ensure MX survivability. MPS would have severe socioeconomic and physical impacts on the deployment region, and could result in the loss of thousands of square miles of productive rangeland.

Adding LoADS to an MPS system could be effective in forcing the Soviets to attack each shelter with two warheads only if both ABM defense and the MX missiles could be hidden from the Soviets and if the ABM defense system could work in the midst of exploding warheads. It is not now certain that these conditions can be met.

Basing MX missiles in silos and relying on launching them before they could be destroyed (LUA) would be technically feasible. However, LUA would require that the President be in continuous contact with the warning sensors and the strategic forces, and that he be prepared to make launch decisions quickly on the basis of information from remote sensors. Possible results of LUA errors include a successful Soviet first strike or an accidental nuclear war; consequently even a small possibility of error is an important consideration.

Deployment of MX missiles on small submarines would provide the United States with military capabilities nearly as good as land basing options. Such submarines would be highly survivable today and

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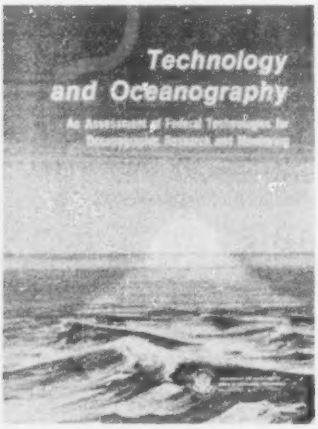
against all future antisubmarine warfare (ASW) threats that OTA was able to project. Small submarine basing would place far greater importance on the sea-based portion of U.S. strategic forces than in the past. This could have serious consequences if an unforeseen Soviet strategic ASW capability were developed.

Air mobile MX basing would be highly survivable provided that the aircraft took off immediately after receiving warning of an attack. If the Soviets chose to attack all of the airfields at which the aircraft could land and refuel, the United States would have to "use or lose" air-mobile-based MX missiles within the first 5 to 8 hours of a war.

The cost of the baseline MX/MPS deployment to the year 2000 is estimated by OTA in fiscal year 1980 dollars at $43 billion and could grow to more than $80 billion if the system were expanded to more than 12,000 shelters to cope with a plausible 1995 Soviet arsenal. Adding an ABM defense would reduce costs of meeting high future Soviet threats by 10 to 20 percent. Small submarine basing costs are estimated to be about $39 billion; the size of the force would not have to be expanded to meet an increased Soviet threat. Costs of an LUA system including the MX missile, warning sensors, and communications systems would be $15 billion to $20 billion.

Technology and Oceanography



Federal ocean research efforts to explore the ocean cost more than $2.5 billion in fiscal year 1980. Some 90 programs conducted primarily by eight Federal agencies range from basic science to resource development to the protection of the marine environment. Yet there is no comprehensive effort to plan and coordinate the development of new technologies to advance these programs.

Oceanographic research is complex; no single technology system is best suited for its tasks. Federally supported technologies include ships, satellites, buoys, submersibles, and other vehicles, as well as independent instrument systems. However, most experts agree that ocean engineering capabilities are inadequate and that important technology development work is not receiving needed attention in some key Federal agencies.

Congressional initiatives may be necessary to strengthen ocean technology development. For example, Congress could: establish a central office to support future ocean technology development in one or more agencies with authority to provide the expertise and project management capabilities for specific missions or program needs; call

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for an evaluation of specific technology development needs not being met by established offices; establish an interagency ocean engineering strategy group with authority for technology transfer and other productive coordinating functions.

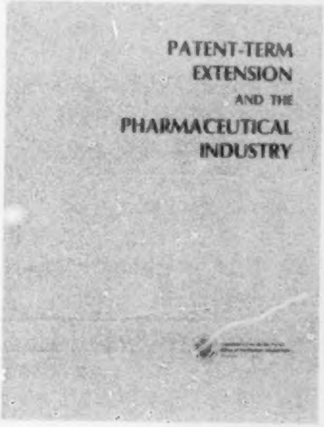
Most ocean research has been conducted from ships. New technologies have not replaced the need for ships but, instead, have identified new and more productive ways to use them. Yet Federal funding for the oceanographic fleet of about 79 ships has declined rapidly. The fleet is not being adequately maintained or upgraded, is decreasing in size, and will require replacement or rehabilitation over the next 20 years. The capabilities of the Federal fleet will continue to degrade without new funds or more efficient arrangements that reduce costs. Several years of debate have failed to resolve whether more centralized management systems with greater Federal control would produce savings greater than their additional cost, especially when funding today is already unable to meet the costs of the existing system.

In the future, increased attention will be given to remotely operated and other unmanned vehicles, buoy systems and moored systems, as appropriate, for many specialized ocean data collection and monitoring tasks. New data links with satellites are making buoys and moored systems more effective.

Major satellite systems for oceanography could become the dominant thrust in ocean technology in the next two decades. The new National Oceanic Satellite System, now in planning, offers the potential of substantial improvements in ocean data gathering, but its projected total development cost of almost $1 billion makes current budgetary support doubtful.

Federal programs have not given adequate attention to the handling of oceanographic data, collected at great expense, for public use. Existing data systems are not meeting the research needs of many oceanographers. Satellites and other remote sensing systems with the potential for generating large volumes of data will compound one area of data management in the future.

Patent-Term Extension



PATENT-TERM
EXTENSION
AND THE
PHARMACEUTICAL
INDUSTRY

Proposals to extend patent terms for products subject to premarketing regulations would, if implemented, provide additional incentives for conducting pharmaceutical research and development (R&D). But evidence is insufficient to determine whether these incentives by themselves would appreciably increase pharmaceutical innovation.

Patents were intended to promote innovation by providing inventors with the right to exclude others from making, using, or selling a patented invention. Because drug developers usually obtain patents before their drugs have been approved by the Food and Drug Administration, the length of the approval process can directly affect the length of time during the patent term that a new pharmaceutical is marketed (the effective patent term).

Drug developers believe that pharmaceutical research is becoming less profitable as a result of shorter effective patent terms, governmental actions encouraging competition from drugs generically equivalent to drugs with expired patents, and higher costs of research.

To date, the profits of the pharmaceutical industry have remained high, revenues have increased steadily, and R&D expenditures have increased to levels which more than compensate for the inflation in biomedical research costs. However, the effects of the decline in effective patent terms and the increased competition resulting from Government actions may not have been fully felt.

Patent-term extension has numerous implications for society, industry, and innovation. The extension would increase the attractiveness of research on drugs for large markets; it would not increase the economic attractiveness of research on drugs for small markets.

Drugs with extended patent terms would generate additional revenues when the majority of the proposed extensions are to begin in the 1990's. The long-term stability of the relationship between R&D expenditures and revenues suggests that increases in research activities would not occur until that time and that 8 or 9 percent of the additional revenues generated would be spent on R&D activities. Industry spokesmen maintain that increased R&D expenditures could be expected sooner because firms would make their research decisions on the basis of anticipated increases in revenues.

As a result of patent-term extension, the prices of drugs whose patents are extended would be higher during the extended period than they would have been without the extension. Consumers would, however, benefit if more and better pharmaceuticals were developed. It is

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expected that both the benefits and the additional costs would affect the elderly and the chronically ill more than other segments of society.

Patent-term extension would delay and in some cases prevent the entry of firms primarily selling drugs that are generically equivalent to drugs with expired patents. The revenues of these firms are determined by the remaining market value of drugs with expired patents—and because of reduced marketing time—the remaining market values would be reduced.

Solar Power Satellites

Although it appears technically feasible for satellites to supply electric power to the Earth in the next century, there is too little information currently available to make a sound decision on whether to develop a solar power satellite (SPS) system.

SOLAR
POWER
SATELLITES

A research program could provide this information. However, the urgency of pursuing SPS research depends less on resolving technical difficulties than on the future growth rate of electricity demand, the relative cost and flexibility of competing electric supply technologies, and the speed with which the major uncertainties about the SPS can be resolved.

The SPS concept envisions collecting solar energy in space and transmitting it to Earth for conversion to electrical power. Microwaves, infrared laser, and mirror reflection have all been suggested as transmission modes. Although it is not yet possible to choose an optimum SPS system, several alternatives to the reference system used for study by the National Aeronautics and Space Administration/Department of Energy offer significant improvements in size, cost, and feasibility.

Major uncertainties are associated with each of the proposed systems. Predominant among these are the environmental and health effects of transmitting energy, the size and location of receivers on Earth, the health risks to space workers from ionizing radiation, and the potential interference with other users of the electromagnetic spectrum. In addition, the high cost,complexity, and possible military impacts of SPS involve institutional and political considerations.

Any SPS system would also raise sensitive questions of international law and trade. Since developing SPS as a multinational rather than a unilateral system could provide significant economic and political advantages, these issues should be taken into account in SPS planning.

The cost estimates to demonstrate a full-scale SPS for the systems studied by OTA exceed $100 billion. Although these estimates are now

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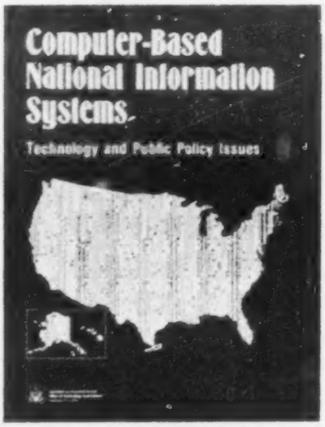
uncertain, demonstration costs are likely to be at least $40 billion (in current dollars). These costs are unlikely to come down for the generation of systems now under study, although it is possible that further innovations may reduce these estimates.

OTA also compared several potential future electricity sources: nuclear breeder, fusion, solar thermal, solar photovoltaics, and SPS. It found that while the capital costs and uncertainties are high for all these technologies, they are highest for fusion and SPS.

If future growth of demand for electricity is expected to be low, it is not necessary to initiate a specific SPS research program at this time. However, it may be desirable to designate an agency to track research applicable to SPS, review trends in electricity demand, and monitor the progress of other electrical supply technologies.

A dedicated SPS research program, started now, might range between $5 million and $30 million per year. Research should focus on those areas most critical to SPS economic, technical, and environmental feasibility with particular attention to analysis of alternative SPS systems. Since the feasibility to SPS also depends on its social, political, international, and institutional acceptability, these aspects should be part of any research program.

Computer-Based National Information Systems



Computers have become a major technological tool of American society during the last quarter of a century. Recent developments in computer and communication technology promise within this decade an even more radical revolution in the way that information is collected, stored, used, and disseminated. These advances offer new opportunities, for example, to improve productivity in the manufacturing and service sectors of the economy.

The development and use of computer-based national information systems—such as those already integral to air traffic control, military command and control, and electronic funds transfer—will be accelerated by major continuing advances in microelectronics, computer programing, and data communication. Small computers will become common in the home and business. Corporations will compete intensively to provide computer-based information services. The number and size of computer networks linking users and data bases anywhere in the country or the world will expand dramatically.

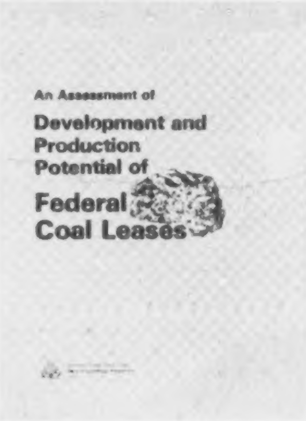
At the same time, computer-based information systems are generating public policy issues at a rate that may be outstripping the ability of the Federal Government to respond. The United States appears to lack a coherent "information policy" to guide the updating of the numerous laws and regulations, some overlapping and some potentially or actually conflicting, that affect the operators and users of information systems. Responsibility for setting policy is diffused throughout various agencies of the executive branch and committees of Congress.

Continued innovation in information technology is a prime requisite for a healthy information industry that is competitive in the world market. It also offers the tools for improving the productivity of many sectors of the economy. Innovation depends on support for research and development on civilian applications of computer technology, vitality of academic computer science, and support for research on the impact of computers (e.g., the impact on employment).

New computer applications—such as an automated securities exchange, in-home information services, electronic publishing, and electronic mail—may introduce policy issues over secondary use of personal information, surveillance, and the possible need for new approaches to the protection of individual privacy. Also, the increasingly complicated systems now being designed and built will magnify the need for adequate protection of Federal information systems and vital non-Federal systems, and for the development of improved data security and cryptographic capability.

Large-scale information systems may also affect Federal decisionmaking (the "automated bureaucracy"), constitutional rights (especially first, fourth, and fifth amendment rights), computer-related crime, international negotiations over the transborder flow of information and regulatory boundaries and definitions for computer-based devices and services.

Development and Production Potential of Federal Coal Leases



An Assessment of
Development and Production Potential of
Federal Coal Leases

Coal production from mines that include currently existing Federal coal leases ("Federal mines") could increase from 138 million tons in 1979 (about 15 percent of national production) to between 410 million tons and 500 million tons by 1991. Whether or not coal production will actually rise that far depends both on overall market demand and on competition from non-Federal mines and production from new Federal leases. The extent of increased market demand, not the availability of leased coal reserves, is expected to determine the amount of coal that will be produced from existing Federal coal leases.

The rate of growth in demand for electricity will probably be the single most important factor affecting demand for Western coal. Other major factors are coal transportation availability and cost and the growth of nonutility markets for coal, such as for industrial use, synfuel production, and foreign exports.

Over 50 percent of the coal produced in 1979 from mines with Federal coal leases came from the Powder River basin of Wyoming and Montana, which has 56 percent of the Federal reserves under lease. In 1979, Federal mines in the Powder River basin had the capacity to produce an additional 75 million tons over what was actually mined. Demand for Powder River basin coal is likely to increase significantly over the next decade. However, production capacity from existing Federal leases and non-Federal coal properties in the basin could also increase substantially. As a result, there is potential for continued significant overcapacity in the Powder River basin over the next decade. Consequently, there is considerable debate about the timing, extent, and location of renewed large-scale leasing of Federal coal lands in that region. In contrast, little overcapacity is expected in the Southern Rocky Mountain coal regions during the same period. During the 1990's, demand for Western and Federal coal may grow rapidly, particularly if coal-based synfuels and exports of coal to foreign countries become important.

The Federal Government owns about 60 percent of the coal reserves in the Western States. By 1980, a total of 812,000 acres and over 16.5 billion tons of recoverable coal reserves in 14 States had been leased. More than 99 percent of these leased Federal reserves are in Colorado, Montana, New Mexico, North Dakota, Oklahoma, Utah, and Wyoming. The OTA report focuses on potential production from the 548 leases in these seven States.

In 1980, 189 of these 548 leases, with 7.4 billion tons of recoverable reserves, were part of active mines. Another 118 existing leases (2.5

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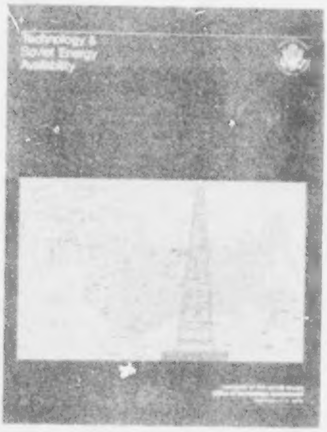
billion tons) with proposed mine plans pending approval could begin producing in the mid-1980's. No mine plans had yet been submitted for 241 leases. However, 75 of these leases (3.6 billion tons) are likely to be in production by 1991; another 65 leases (2.3 billion tons) could begin by 1991 contingent on markets for coal, including demand for synthetic fuels, and on railroad construction. There are 101 leases, with about 5 percent of the reserves, that are unlikely to be developed because of poor reserves, remote location, or environmental problems.

Less than 1 percent of currently leased Federal reserves are likely to be prohibited from mining because of environmental regulations concerning air quality, water resources, alluvial valley floors, return to approximate original contour, and wildlife. Mining of between 5 and 10 percent of leased reserves could be delayed because of unresolved environmental questions, but available evidence indicates that most can be mined.

Technology and Soviet Energy Availability



No U.S. policy of restricting Soviet access to energy technology is likely to succeed unless U.S. allies change their present views of their interests in this matter. A policy intended to bolster Soviet energy production would not succeed without significant changes in Soviet economic policy. A course of action seeking maximum commercial advantage for the United States in energy equipment sales would be aided by making the export licensing process more predictable.

The vast majority of the U.S.S.R.'s energy-related imports of technology are destined for its oil and natural gas industries, but it obtains most of these from sources outside the United States. There are a few energy technologies solely available from the United States, and a few instances in which U.S. equipment is preferred. But except for advanced computers, the U.S.S.R. is either not purchasing these items, is on the way to acquiring domestic production capabilities, or has demonstrated that such imports are not essential. Moreover, the United States does not produce the large diameter pipe that constitutes the U.S.S.R.'s single most important energy-related import.

Western technology has been and will continue to be important to Soviet energy development. In the long term, Western exploration technology and equipment may be crucial to the oil industry. But the

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most vital area for such Western assistance is equipment for the construction of large diameter gas pipelines. This is the only area in which Soviet energy-related imports might be described as "massive."

Contrary to common belief, oil is not the key to Soviet energy performance in this decade. The relevant question is not how much oil the U.S.S.R. can produce by 1990, but how much energy. Predicting future Soviet energy production is a tenuous exercise, but to the extent that plausible outcomes can be identified, the Soviet's own goal of a small rise in oil output by 1985 is reasonable. On the other hand, prospects for the Soviet coal industry are poor; even the relatively modest 1985 targets are excessively optimistic. Soviet targets for nuclear power are overly optimistic—not because of lack of know-how, but because of shortcomings in the efficiency and capacity of producing the required equipment and constructing power stations. OTA also found that potentially large savings through energy conservation are not likely to be achieved.

Gains in total energy production will therefore have to come from gas. Proven Soviet gas reserves may be likened to the oil reserves of Saudi Arabia. This is the energy sector with the best prospects and performance record, and Soviet planners have accorded it high investment priority.

Gains in gas output could more than compensate - both in energy value and in hard currency earnings—for slowing growth in oil production. It is therefore highly unlikely that the Soviet Union itself or the Soviet bloc as a whole will become a net energy importer in the 1980's.

The extent to which the U.S.S.R. can capitalize on its tremendous gas potential will depend on its ability to substitute gas for oil, i.e., to convert to gas in boiler and industrial applications, and to add to the gas pipeline network. The rate of construction of new pipelines, both for domestic use and for export, is the most important determinant of the extent to which Soviet gas can be utilized.

Energy availability is a critical factor in the growth of the Soviet Union's domestic economy; energy exports provide over half of Soviet hard currency receipts; and subsidized energy sales to Eastern Europe are vital tools of Soviet influence in that region. From the perspective of Japan and some countries in Western Europe, Soviet energy industries are important customers for equipment and technology and a source of energy supplies.

U.S. Food and Agricultural Research System

The structure of the U.S. food and agricultural research system may need to be changed if it is to function effectively and to meet the increased demand on its resources.

United States
Food and
Agricultural
Research
System

The United States is widely recognized as a leader in agricultural research largely because of technologies developed through sustained public support. Scientists now are concerned that new technologies may not be keeping pace with domestic and world needs. Unless major breakthroughs occur in new technologies, the world food problem is likely to worsen.

However, the U.S. food and agricultural research system is working under a number of constraints that diminish its effectiveness. These include lack of well-defined national agricultural goals, lack of a national research priorities process, underinvestment in research, confusion over roles of research participants, and a structure that inhibits the system from having a national research focus.

Lack of well-defined, achievable national goals for U.S. food and agriculture is a major deterrent to formulating a national policy to guide the research community in planning its agenda. Present goals are implicit but ambiguous and open-ended, such as to provide an ample supply of food. But this has little meaning in the absence of an agreement on what constitutes an ample supply. Explicit, well-defined and achievable goals could be set—either by the research community or by Government. If set by Government, public agencies and industry could respond by planning and conducting research that would more adequately meet national needs.

The United States has no satisfactory long-term process for evaluating existing research activities, potential research opportunities, and development of research priorities. Decisions are made on an ad hoc basis with insufficient coordination among Federal and State agencies. The research system could benefit from preparation of a national research agenda that could be updated at scheduled intervals.

U.S. Department of Agriculture (USDA) research expenditures are proportionately the smallest of any major Federal research agency and have remained level in constant dollars since 1967. Yet, the demands on agricultural research have increased and the cost of conducting research has increased substantially. The executive branch and Congress could reassess whether existing funding priorities in agriculture support are appropriate.

Under the present research structure, USDA's role is associated with broad regional, national, and international activities, and the

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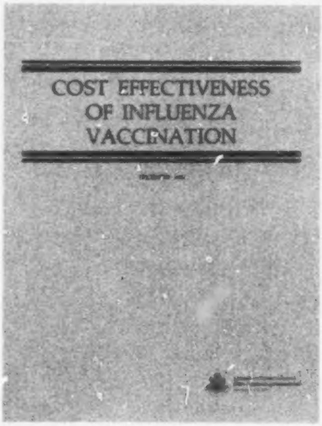
State agricultural experiment stations with local, State, and regional problems, insofar as Federal funds are concerned. However, considerable overlap exists and there is increasing concern that national issues are not receiving adequate attention. The OTA study presents a variety of options for congress to strengthen and clarify the roles of research participants.

USDA's structure hinders its ability to manage and conduct research with a national focus and to be fully responsible to the agricultural needs and interests of the United States. However, within the past few months, the executive branch has moved to improve some aspects of research management within USDA, particularly in its former Science and Education Administration. Still needed are improved procedures for managing research in the Agricultural Research Service and the Cooperative State Research Service.

The Agency for International Development (AID), the prime Federal agency involved in strengthening agriculture in developing nations, lacks the adequate technical skills and management structure for handling the job effectively. The OTA study indicates that AID could benefit through the establishment of technical bureaus centered around the major thrusts of AID programs. and by increased use of USDA as a technical resource.

Cost Effectiveness of Influenza Vaccination

Influenza vaccination is a low-cost method of preventing illness and reducing productivity losses. Vaccination benefits all age groups, but is most cost effective among high-risk persons, i.e., the elderly and those with preexisting illnesses. Yet, the use of influenza vaccination is still at too low a level for society to reap substantially its potential benefits.



COST EFFECTIVENESS
OF INFLUENZA
VACCINATION

Over the period of 1971-78, approximately 150 million influenza vaccinations resulted in about 13 more years of healthy life. This was achieved at a cost of $63 per year of life gained, and, according to this OTA analysis, about $386 million in potential productivity losses were averted.

During the same period, influenza caused an estimated 127,000 deaths and cost about $1 billion for medical treatment. The illness also resulted in an average of 15 million days of work loss at an estimated productivity loss of $764 million in each of those years.

Although vaccination is the medically preferred method of preventing the illness, influenza vaccine has never received widespread acceptance by either health professionals or the public. Throughout most of the 1970's only 10 percent of the Nation's population received influenza vaccine; further, only about 20 percent of the population most susceptible to influenza-related illness were vaccinated. How-

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ever, in 1976-77 when the Federal Government launched the National Influenza Immunization Program, these percentages doubled.

In spite of the incidence of the paralytic condition Guillain-Barré Syndrome (GBS) associated with the so-called "swine flu" vaccine in 1976-77, influenza vaccines have proven to be quite safe. Subsequent to that year, the incidence of GBS among influenza vaccinees has been virtually the same as that among nonvaccinees. About 5 percent of the adult vaccinees encounter a mild reaction. OTA estimates that the clinical effectiveness of influenza vaccine was about 60 percent in 1971-78.

At present, the Federal Government spends little effort to promote the use of influenza vaccine. Through its Food and Drug Administration, the Government evaluates the safety and efficacy of influenza vaccine, and through the National Institutes of Health and Centers for Disease Control it finances epidemiologic and biomedical research on influenza and influenza vaccines.

If the Government decided to promote the use of influenza vaccine, it could do so in three ways:

- The Public Health Service could fund a national campaign to stimulate private sector elements, e.g., health professionals, employers, labor unions, and the public, to increase its use of the vaccine;
- Congress could appropriate Federal funds for support of annual nationwide influenza immunization programs analogous to federally supported childhood immunization efforts; and
- Congress could authorize medicare to pay for influenza vaccinations.

TECHNICAL MEMORANDUMS

Coal Export and Port Development

This Technical Memorandum explores four major issues: estimating the potential U.S. coal export market; development of foreign trade policy; the Federal role in dredging harbors; and the outlook for alternative technologies that might facilitate coal exports.

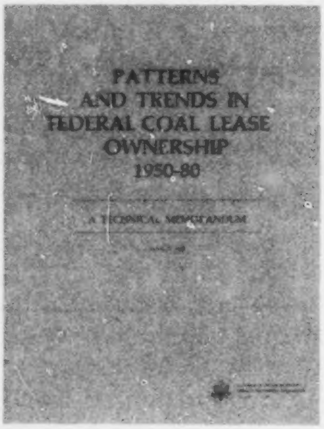
Indications are that sizable increases in future U.S. coal exports are achievable if the Federal Government and the private sector cooperate in encouraging these exports, and if developments in other countries do not dramatically alter present trends. However, without the development of a coherent, positive coal export policy. the United States risks losing a large share of the market to other coal-producing nations.

It is suggested that in order to promote U.S. coal exports, it is important to reaffirm the U.S. commitment to increase domestic coal production, improve the coal transportation network, and encourage export trade. The resulting political climate would reassure importing nations as they assess U.S. reliability as a future coal trade partner.

OTA's analysis indicates general agreement on the need for some changes in Federal dredging policies. The economic rationale for recovering dredging costs in some form of user fees from those who directly benefit is gaining acceptance. Technologies other than dredging that facilitate coal exports will probably be approached with caution by established industries because they are not perceived as near-term options. Alternative technologies include: coal slurry pipelines, midstream transfer of barges or ships, barge-carrying ships, pneumatic pipelines, and shallow-draft, wide-beam ships.

Patterns and Trends in Federal Coal Lease Ownership, 1950-80

This Technical Memorandum is part of OTA's congressionally mandated study (Public Law 94-377) of current Federal coal leases. The full OTA report published in December 1981 is entitled: "Development and Production Potential of Federal Coal Leases."


PATTERNS AND TRENDS IN FEDERAL COAL LEASE OWNERSHIP 1950-80

A TECHNICAL MEMORANDUM

Since 1920, the Department of the Interior has conducted a leasing program through which the private sector is given permission to mine coal in Federal lands. Over the past 60 years, about 17 billion tons of coal on 790,000 acres have been leased. Land currently under lease represents about 12 percent of the total coal reserves owned by the Federal Government. Federal coal lessees are contributing an increasing share of the coal industry's total production—from 1 percent in 1970 to 8 percent in 1979—when total production from leased land was 60 million tons. Production on leased land is expected to increase substantially over the next 5 years.

The history of the 528 coal leases in effect at the end of 1979 is traced and focus is placed on the coal lessees themselves: who they are, how and when they acquired Federal coal leases, and what they have done with those leases. Participants in the Federal coal leasing program between 1950 and 1980 are identified.

The number of lessees participating in the coal leasing program has nearly doubled over the past 30 years and the total acreage of leased land has increased eighteenfold. In 1950, unincorporated individuals and independent corporations held 72 percent of all land under lease. Today, the percentage of leased Federal coal acres they hold has decreased to 31 percent. The holdings of subsidiary corporations, which were 26 percent of the 1950 total, have risen to 43 percent in 1980. Multicorporate entities, defined as either joint ventures or two or more companies sharing interests in leases, now hold 25 percent of leased acreage, up from less than 1 percent in 1965.

The shifts in lease ownership have led to a greater variety of industries holding Federal coal leases. For 1950, OTA identified only four distinct kinds of businesses, each of which held at least 5 percent of all land under lease. Independent coal companies were the leading lease holders. By 1980, nine distinct kinds of businesses were identified as each holding at lease 5 percent of leased land, with electric utilities owning more Federal coal land than any other industry group. Integrated energy companies are the second largest lease holder today, with 20 percent of all acres under lease and producing 16 percent of all Federal coal.

Nonnuclear Industrial Waste: Classifying for Hazard Management

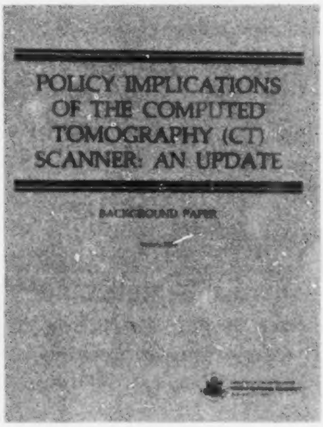
The management, or mismanagement, of industrial waste presents various levels of hazard to the public. Nonnuclear industrial waste ranges from being relatively harmless to being so extremely hazardous that it must be completely isolated from humans and the environment, destroyed, or detoxified. This technical memorandum is part of a comprehensive assessment of nonnuclear industrial waste scheduled for completion in 1982.

Some of the key findings of the OTA analysis are: 1) A well-designed degree-of-hazard classification system could provide a strategy for cost-effective management of nonnuclear industrial waste; 2) The objectives of a classification system are to identify with greater certainty those wastes that most severely threaten human health and environment; and 3) the benefits of using degree-of-hazard classification include concentration of regulatory action on the most hazardous wastes.

BACKGROUND PAPERS

Policy Implications of the Computed Tomography (CT) Scanner: An Update

At the request of the Senate Finance Committee, this background paper updates the 1978 OTA report, "Policy Implications of the Computed Tomography (CT) Scanner."


POLICY IMPLICATIONS
OF THE COMPUTED
TOMOGRAPHY (CT)
SCANNER: AN UPDATE

BACKGROUND PAPER

The United States has the greatest number of CT scanners per population of any country in the world. In May 1980, there were 1,471 scanners, or 6.7 per million people. Within States, the number of scanners per million varies from 12.8 in Nevada to 2.4 in South Carolina.

The dramatically rapid rate of scanner diffusion (the process by which a technology enters and becomes part of the health care system) during 1975 and 1976 set the stage for OTA's original study. An equally dramatic decline in this rate from 1978 through 1980 is the backdrop for the update.

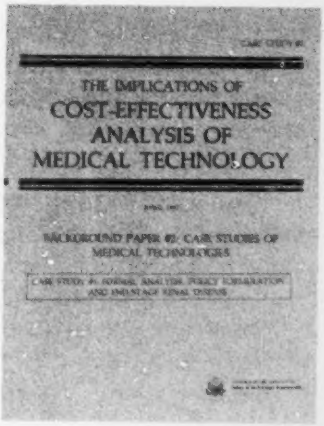
The decline in the diffusion rate has occurred during a period of changes in Federal policies toward medical technology affecting every stage of research, development, diffusion, and use of CT scanners.

CT scanners, which combine X-ray equipment with a computer and TV-like picture tube to produce cross-section images of the human body, revolutionized diagnostic medicine in the United States when first introduced in 1973. Over the past 7 years, new applications of existing and new technologies have rapidly expanded the field of "diagnostic imaging" (making pictures of the inside of the human body). R&D in this new field is described and information on new developments such as ultrasound and nuclear magnetic resonance scanners is presented.

Some key issues are: Can the relative advantages of the different technologies be demonstrated? Can Federal policies rationalize the use of the many technologies? Will new technologies merely be added on to existing methods, driving up costs and contributing only marginal benefits to people's health? An examination of public policy toward CT scanning may indicate how far we are from having effective policies to promote the efficient expenditure of our health care dollar.

The Implications of Cost-Effectiveness Analysis of Medical Technology

Analyzes the feasibility, implications, and usefulness of cost-effectiveness analysis (CEA) and cost-benefit analysis (CBA) in health care decisionmaking, including the current and potential use of CEA/CBA or related techniques in six health care activities: reimbursement programs, Professional Standards Review Organizations, health planning, market approval for drugs and medical devices, R&D programs, and health maintenance organizations.



THE IMPLICATIONS OF
COST-EFFECTIVENESS
ANALYSIS OF
MEDICAL TECHNOLOGY

BACKGROUND PAPER #2: CASE STUDIES OF
MEDICAL TECHNOLOGIES

In addition to the main report (published in August 1980), there are five background papers: 1) *Methodological Issues and Literature Review*, published September 1980; 2) *Case Studies of Medical Technologies*, consisting of 17 individual case studies, 15 of which (listed below) were published in 1981. The final two case studies (#9—The Artificial Heart; and #13—Cardiac Radionuclide Imaging and Cost Effectiveness) are in press; 3) *The Efficacy and Cost Effectiveness of Psychotherapy*, published October 1980; 4) *The Management of Health Care Technology in Ten Countries*, published October 1980; and 5) *Assessment of Four Common X-Ray Procedures*, in press.

Case Study 1: Formal Analysis, Policy Formulation, and End-Stage Renal Disease.—Examines two instances of the use of formal analysis in the formulation of Government policies toward end-stage renal disease (ESRD). Focus is on the work of two committees, whose reports were an integral part of the ESRD policy formulation process in 1966 and 1967: 1) the Gottschalk committee, advisory to the U.S. Bureau of the Budget; and 2) the Burton committee, internal to the Public Health Service.

Case Study 2: The Feasibility of Economic Evaluation of Diagnostic Procedures: The Case of CT Scanning.—Computed tomographic (CT) scanning can now be used to detect diseases in other parts of the body. The use of this diagnostic technology has initiated a controversy of unprecedented proportions regarding tradeoff between the benefits and costs of CT scanning.

Case Study 3: Screening for Colon Cancer: A Technology Assessment.—Examines the available technologies used to screen for cancer of the colon: their development, evaluation, cost effectiveness, and use. Although cancer of the colon is second in frequency to cancer of the skin, second to cancer of the lung as a cause of death in men, and the third most common cause of cancer death in women, it is overall the most common of the "lethal" cancers.

Case Study 4: Cost Effectiveness of Automated Multichannel Chemistry Analyzers.—A multichannel chemistry analyzer is a technology capable of performing many laboratory tests simultaneously on a single sample of serum at extremely high speeds. The study reviews the evidence concerning the cost effectiveness of the three cardiac enzyme tests used to diagnose heart attacks.

Case Study 5: Periodontal Disease: Assessing the Effectiveness and Costs of the Keyes Technique.—Over 90 percent of the adult population in the United States is at some time afflicted with some degree of periodontal disease. The Keyes treatment technique essentially involves the use of simple and inexpensive oral hygiene measures and plaque (bacterial) control by the patient.

Case Study 6: The Cost Effectiveness of Bone Marrow Transplant Therapy and Its Policy Implications.—Bone marrow transplant (BMT) therapy is a relatively new medical technology used to treat aplastic anemia and acute leukemia. The data used in the case study for the CEA of BMT therapy were obtained from the UCLA Bone Marrow Transplantation Program and were collected on 107 patients with aplastic anemia and acute leukemia who were given BMT therapy.

Case Study 7: Allocating Costs and Benefits in Disease Prevention Programs: An Application to Cervical Cancer Screening.—Examines the financial incentives of various interested parties to fund cervical cancer screening and examines the cost effectiveness of screening under various conditions.

Case Study 8: The Cost Effectiveness of Upper Gastrointestinal Endoscopy.—Upper gastrointestinal endoscopy refers to looking at the upper gastrointestinal tract from the esophagus to an upper portion of the small intestine. The instrument used is a flexible fiberoptic endoscope.

Case Study 10: The Costs and Effectiveness of Neonatal Intensive Care.—Neonatal intensive care consists primarily of using highly sophisticated life-support systems to compensate for an infant's lack of full development. The most common technologies are respirators and positive pressure breathing devices for treatment of respiratory distress syndrome, a disorder caused by the infant being born before the lungs are ready for breathing air.

Case Study 11: Benefit and Cost Analysis of Medical Interventions: The Case of Cimetidine and Peptic Ulcer Disease.—Peptic ulcer is a common disease that affects millions of Americans at some time during their lives. Since March 1978, cimetidine has been prescribed in approximately 60 percent of all ambulatory visits for ulcer disease.

Case Study 12: Assessing Selected Respiratory Therapy Modalities: Trends and Relative Costs in the Washington, D.C., Area.—In its analysis of trends in the use of different respiratory therapy methods, based on data from the Washington, D.C., area, the case study found that the number of IPPB treatments per 100 admissions decreased about 70 percent, and ultrasonic nebulizer treatments approximately 75 percent. The number of simple aerosol treatments increased over 300 percent and incentive spirometry treatments increased more than 100 percent.

Case Study 14: Cost Benefit/Cost Effectiveness of Medical Technologies: A Case Study of Orthopedic Joint Implants.—The purpose of this study is the assessment of the feasibility and potential usefulness of undertaking cost-effectiveness/cost benefit analysis (CEA/CBA) of orthopedic joint prostheses.

Case Study 15: Elective Hysterectomy: Costs, Risks, and Benefits.—This study concludes that none of the analyses of the risks, costs, and benefits of hysterectomy has found it to be cost effective for sterilization or the prevention of uterine cancer. Most of the costs and risks of hysterectomy occur in the present, whereas the savings and benefits occur when uterine diseases are avoided in the future.

Case Study 16: The Costs and Effectiveness of Nurse Practitioners.—The concept of using nonphysician health professionals to perform basic medical services traditionally provided by physicians emerged in the mid-1960's amidst widespread concern over a perceived physician shortage. Currently there are 22,000 physician extenders in active practice: 13,000 NPs and 9,000 PAs.

Case Study 17: Surgery for Breast Cancer.—Statistics indicate that when breast cancer is discovered in a localized state, the 5-year survival rate is 85 percent. Almost 50 percent of women with breast cancer eventually die of the disease.

TESTIMONY

- House Committee on Interior and Insular Affairs, Subcommittee on Public Lands and National Parks: MX Missile Basing
- Senate Committee on Finance: The Professional Services Review Organization and its potential in medical technology assessment activities
- Senate Committee on Governmental Affairs, Subcommittee on Energy, Nuclear Proliferation and Government Processes: Biomass
- Senate Committee on Labor and Human Resources: National Centers for Health Statistics, Health Services Research, and Health Care Technology
- Senate Committee on Labor and Human Resources: National Library of Medicine Report and the Medical Library Assistance Act
- House Committee on Appropriations, Subcommittee on Interior: Department of Energy's conservation programs
- House Committee on Energy and Commerce, Subcommittee on Energy Conservation and Power: Cogeneration and small power production
- House Committee on Energy and Commerce: OTA Assessment on Determining Cancer Risks from the Environment as it relates to the Toxic Substances Control Act
- Senate Committee on Judiciary, Subcommittee on Administrative Law and Government Relations: Regulatory Procedure Act of 1981
- House Committee on Veterans Affairs: OTA oversight of VA Agent Orange Study
- House Committee on Energy and Commerce, Subcommittee on Health and Environment: Clean Air Act and its relationship to energy development
- House Committee on Interior and Insular Affairs, Subcommittee on Energy and Environment: Nuclear Power Plant Standardization
- House Committee on Science and Technology, Subcommittee on Investigations and Oversight: Energy Models and their role in energy policy analysis
- House Committee on Science and Technology: Needs and benefits of health data and health information systems
- Senate Committee on Appropriations, Subcommittees on Defense and Military Construction: MX Missile Basing
- House Committee on Science and Technology, Subcommittee on Energy Research and Production: H. R. 1909: Nuclear Waste Research, Development, and Demonstration Act of 1981
- House Committee on Interior and Insular Affairs, Subcommittee on Public Lands and National Parks: MX Missile Basing

- Senate Committee on Environment and Public Works: Interstate air pollution
- Senate Committee on Finance: U.S. trade policy
- House Committee on Science and Technology, Subcommittee on Investigations and Oversight: Toxic substances research and the National Toxicology Program
- House Committee on Merchant Marine and Fisheries: Promotion, financing, and facilitation of maintenance and deep draft improvement projects for U.S. ports
- House Committee on the Judiciary; Subcommittee on Courts, Civil Liberties and the Administration of Justice: Patent term extension
- House Committee on Science and Technology, Subcommittee on Energy Development and Applications: District heating and cooling
- House Committee on Science and Technology Subcommittee on Energy Research and Development: The High-Level Radioactive Waste Management and Policy Act and H. R. 1993: The Radioactive Waste Research, Development and Policy Act
- Senate Committee on Energy and Natural Resources and Senate Committee on Environment and Public Works, Subcommittee on Nuclear Regulation: The High-Level Radioactive Waste Management and Policy Act and H. R. 1993: The Radioactive Waste Research, Development and Policy Act
- House Committee on Science and Technology, Subcommittee on Science, Research, and Technology: Use of animals in medical research and cancer testing
- Senate Committee on Energy and Natural Resources: S. 1544: The State and Local Energy Block Grant Act of 1981
- Senate Committee on Environment and Public Works: Proposed legislation (S. 1706 and S. 1709) related to acid precipitation control
- House Committee on Energy and Commerce, Subcommittee on Fossil and Synthetic Fuels and House Committee on the Interior and Insular Affairs, Subcommittee on Energy and the Environment: Alternatives to the Alaskan natural gas transportation system
- Senate Committee on Banking, Housing, and Urban Affairs: The West Siberian gas export pipeline
- House Committee on Energy and Commerce, Subcommittee on Oversight and Investigations: Hazardous waste sites
- Senate Committee on Veterans Affairs: Agent Orange Study
- House Committee on Government Operations, Subcommittee on Commerce, Consumers, and Monetary Affairs: Santa Fe International—energy technology transfer
- House Committee on Science and Technology, Subcommittee on Oversight and Investigations: Soviet energy availability

Section III.—Work in Progress

OTA's work is structured along three broad divisional lines: energy, materials, and international security; health and life sciences; and science, information, and natural resources. Within those broad divisions, OTA conducts studies in energy, international security and commerce, materials, food and renewable resources, health, human resources, communication and information technologies, oceans and environment, and space technology.

More than 40 projects were in progress during the year, including 10 new studies.

In this section, the broad concerns and current work schedule of each OTA division are described for 1982 and beyond.

ENERGY, MATERIALS, AND INTERNATIONAL SECURITY

Energy Efficiency of Buildings in Cities

This assessment focuses on the interaction of technology and policy for new and existing buildings in U.S. cities for the next two decades. The massive current stock of buildings contains a high proportion of structures, both residential and commercial, constructed in a period of low energy cost, when no attention was paid to the continuing cost of energy use over time. Improving the energy efficiency of these structures is important from the point of view of energy policy, city viability, and the interests of individual owners and tenants.

This OTA study analyzes retrofit technologies, both to conserve energy and to employ renewable energy that can improve the energy efficiency of structures. Capital costs, energy savings, and factors such as reliability and maintenance are identified. A second principal portion of the study is an exploration of the type of policy most likely to actually produce an investment in the efficiency of building energy by various types of building owners. Regional factors affecting city opportunities constraints, choices of action open to Federal, State, and city governments, and the related impacts of various policy choices are explored.

Delivery date: Early 1982. Call 224-8996 for further information.

Requesters: House committees: Banking, Finance, and Urban Affairs; Energy and Commerce.

Industrial Energy Use

This project is designed to examine a series of four American industries (pulp and paper, steel, petroleum refining, and organic chemical production) for their potential to use energy more efficiently, and to predict the impact of selected legislative options on energy use and efficiency within those industries.

OTA will examine the available technologies designed to improve energy efficiency, as well as the barriers to such technology's implementation. The legislative options to be examined range from tax policy changes such as accelerated depreciation to institutional changes in capital financing methods. Each option's effects will be evaluated through a series of case studies in which corporation executives, consultants, and computer-modeling techniques are used to forecast the impacts of possible congressional action. Options will also be examined at the industry, industrial sector, and national energy use and economic levels using a similar series of modeling, management, and consultant evaluations.

Delivery date: Summer 1982. Call 226-2152 for further information.

Requesters: House Committee on Energy and Commerce. Senate Committee on Finance.

Synthetic Fuels for Transportation

Synthetic fuels for transportation is a project in the Energy Program to assess various synthetic fuels that can be used for transportation and automotive technology that can increase passenger car fuel efficiency beyond 1985 standards, and to compare these two options. The issue is how best to balance these approaches, as the synthetic fuel program develops and efficiency increases are contemplated, to achieve the most effective and economic path to reduced dependency on imported oil.

The Energy Program will review the technical, economic, environmental, and social features of the major synthetic fuels and automotive technology (increased automobile fuel efficiency and electric vehicles) including information from reports by the Congressional Research Service, the Congressional Budget Office, and OTA studies on oil shale and biomass. In addition, potential oil savings through increased efficiency and fuel-switching in stationary uses of oil will be briefly described. Synthetic fuels and increased automobile fuel efficiency will then be compared using a variety of criteria, including consumer and investment costs, time frame for deployment, environmental impacts, and macroeconomic impacts. Selected issues related to these subjects will be discussed and policy options developed.

Delivery date: Early 1982. Call 226-2152 for further information.

Requester: Senate Committee on Commerce, Science, and Transportation.

Industrial and Commercial Cogeneration

The need to reduce U.S. dependence on expensive and scarce petroleum as a primary fuel in the industrial, commercial, and electric utility sectors has created a resurgence of interest in cogeneration—the combined production of both electric power and heat or steam in one technological process. Because the total amount of fuel needed to produce both power and heat/steam in a cogenerator is less than the total fuel needed to produce the same amount of power and heat/steam in separate technologies (e.g., a powerplant and an industrial boiler), cogenerators can contribute to our Nation's efforts to use fuel more efficiently. Moreover, problems faced by the electric utility industry, including rapidly rising capital costs, long leadtimes for powerplant construction, and difficulties in finding suitable sites, may make cogenerators an attractive alternative to conventional central station powerplants. This assessment will examine the role that cogenerators could play in providing electric and thermal energy for industrial and commercial facilities while distributing electricity to the utility grid. It will review the economic, environmental, social, and institutional consequences of cogeneration, with a special emphasis on the potential effects on the electric utility industry's planning and operations. Finally, the study will analyze policy options that Congress may wish to consider in addressing the issues about the development of cogeneration systems.

The assessment will examine the technical features of commercial and advanced cogeneration technologies, including requirements for connecting cogenerators to the utility grid and technologies for storing thermal or electrical energy. It will then evaluate the economic and technical effects of grid-connected cogeneration systems on electric utilities using a computer model that minimizes the costs of providing electric and thermal power. A major focus of this evaluation will be the potential effects of oil- and gas-fired cogenerators on overall oil/gas use. Finally, a series of issues on the incentives for cogeneration in the industrial and commercial sectors, and on the economic, environmental, and social effects of cogeneration will be examined.

Delivery date: Early 1982. Call 226-2152 for further information.

Requesters: House committees: Banking, Finance, and Urban Affairs; Energy and Commerce; Science and Technology.

Strategic Technologies for an Oil Disruption

Over the next decade, there is a high probability that the Nation will experience a disruption in imported oil of a level that will exceed the capabilities of the Strategic Petroleum Reserve and seriously affect the economy.

This assessment will examine the opportunities and problems that characterize various technical responses that could supplement the

Strategic Petroleum Reserve to meet such an interruption. The objective will be to determine what available resources might be expanded, the technical limitations for fuel substitution and switching, the physical constraints of stockpiling resources, and the impacts of accelerating the use of these technologies. Technologies to be considered will include enhanced oil recovery; adapting industrial boilers to dual-fuel capacity; biomass production; high-voltage transmission; hydro; wind; direct solar; vehicle retrofits; photovoltaics; retrofitting building envelopes and heating/cooling systems; retrofitting vehicles to improve mileage efficiency; and switching capacity of petroleum refineries. The study will be done at national and regional levels.

The assessment will be completed in two phases. Phase I will draw on OTA staff resources to collect data on the technical capabilities and constraints of the intervention technologies, and develop a summary document on potential of the technologies to alleviate the effects of various levels of oil disruption. A workshop will be held to review the data, and a Technical Memorandum will be published. In Phase II, OTA will examine the most promising technologies in greater detail, including complicated questions such as refinery-switching capacity, burner substitution logistics, electrical grid capacity and requirements.

Delivery date: Technical Memorandum, Fall 1982. Full Report, early 1983. Call 226-2152 for further information.

Requesters: Senate committees: Governmental Affairs; Foreign Relations.

Potential U.S. Natural Gas Availability

In the past few years there has been a change in the outlook about the potential for natural gas production in the lower 48 States. Recent optimistic projections by some groups have stimulated efforts to revise current natural gas policy so that natural gas can play a bigger role in reducing this country's oil imports. There remains, however, considerable uncertainty about how much the United States can rely on natural gas, which is tempering this optimism. This assessment is designed to help determine domestic (lower 48 States) onshore natural gas availability over the next few decades, and to help understand the factors that affect this availability. The OTA assessment will: 1) analyze the key technical and physical parameters that determine the resource base, production rates, and costs of all categories of below-ground natural gas; 2) critically review current estimates of the resource base; estimate the potential production rates of natural gas, and analyze the uncertainties in these estimates; 3) assess future technology trends, research and development needs that may accelerate these trends; and 4) analyze the institutional and policy issues appropriate for a Federal role in dealing with barriers to production.

Delivery date: Spring 1983. Call 226-2152 for further information.

Requester: House Committee on Energy and Commerce.

Nonnuclear Industrial Hazardous Waste

Many nonnuclear industrial hazardous wastes must be stored or disposed of with great care or they may constitute a threat to health and the environment. Information on the nature and magnitude of the hazardous waste disposal and abandoned site problem will be reviewed. The reliability and efficacy of present containment, abatement, and disposal measures will be assessed. This information, coupled with criteria and techniques to judge relative health and environmental hazards of a given waste, will assist in identifying those wastes that could be reduced at the source—by modifications in process technologies, by recycle, or by an end-use substitution. Approaches for reducing hazardous waste generation with minimal undesirable economic effects on domestic industry will be identified.

This assessment has four objectives: 1) to assess criteria for defining hazardous waste and for judging the relative health and environmental hazards of a given waste; 2) to evaluate technologies for cleaning up present waste disposal sites that are hazardous to health and the environment; 3) to assess technologies and approaches for the safe storage or disposal of hazardous waste being presently generated; and 4) to assess technologies and approaches for reducing the volume of hazardous waste. The possible economic impacts on domestic industry of various approaches will be evaluated.

The project will focus initially on understanding the adverse consequences of present disposal strategies and techniques, and next on ways of reducing generation of industrial hazardous waste economically. Alternative options will be developed to cope with hazardous waste disposal in the short run and hazardous waste generation in the long run.

Delivery date: Technical Memorandum published November 1981; Full Report due fall 1982. Call 226-2269 for further information.

Requester: House Committee on Energy and Commerce.

Wood: The Material, The Resource

The United States has 483 million acres of commercial forestland; 14 billion cubic feet of timber were harvested in 1976. However, the United States still imports nearly 30 percent of its softwood lumber, approximately half of the wood pulp, and significant quantities of plywood. The forest industry and Government experts state that with new technologies for improved forestry practices, better wood utilization, and new product development the United States could become at least independent of wood imports and possibly a net exporter of wood. If domestic wood production is to be increased significantly, policies will be needed to: 1) improve the management of private timberlands; 2) resolve conflicts among the users of Federal public lands; and 3) investigate new uses and applications of wood materials. New technologies for the use of wood, which is a renewable resource, may also hold promise as substitute for nonrenewable energy and materials resources in some applications.

This assessment has six objectives: 1) explore the properties, uses, and technologies for using wood as a material and its potential for substituting for nonrenewable materials; 2) assess the future demand and supply profiles of wood and identify future problems; 3) evaluate the capability of forest management technology to increase production; 4) analyze the forest management policies on public lands in reference to wood production and other forest uses; 5) assess the national technology for wood and forestry R&D; and 6) review public policies that affect forest production and the use of wood as a material and identify policy options for the consideration of Congress.

The assessment is being conducted by the OTA Materials Program with consultation among other OTA program offices and other congressional agencies. Ample use will be made of the planning documents and assessments directed by the Forest and Rangeland Renewable Resources Planning Act and the National Forest Management Act of 1976. Initial efforts will center on the identification of policy issues affecting the production and use of wood materials. A comprehensive review of wood technology and the potential for the future development of wood products will be undertaken. An assessment of the current state of forestry technology and the extent of its application in the field will be conducted.

The assessment will cover a period of 18 months: from October 1981 through March 1983. Two interim Technical Memorandums are planned: 1) Technologies for Improved and Expanded Wood Utilization, and 2) Technologies for Improved Forest Management.

Delivery date: Early 1983. Call 226-2269 for further information.

Requester: Senate Committee on Appropriations.

Impact of Technology on Competitiveness of U.S. Electronics Industry

There is a growing concern that key U.S. industries are declining in their international competitive positions. The electronics industry is particularly significant because it occupies a strategic position as a technological driving force for other industries that use products like semiconductors and computers. The OTA assessment will look at three sectors of this industry: consumer electronics (where the United States has suffered heavily from Japanese competition); semiconductors (where a strong U.S. position is under challenge); and computers (where the United States still appears to lead the world).

The assessment will focus on those major contributors to the competitiveness of the electronics industry that could most readily be affected by U.S. Government policy. In each case, a comparison will be made between the United States, Japan, and (to a lesser extent) Western Europe. These major factors are: 1) commercialization of research, development, and design; 2) manufacturing techniques and resources; 3) finance, including both private and public sources of funds; 4) human resources, both quantity and quality; and 5) governmental industrial policies.

Delivery date: Summer 1982. Call 226-2012 for further information.

Requesters: Senate Committee on Commerce, Science, and Transportation. Joint Economic Committee.

Strategic Command, Control, Communications, and Intelligence (C^{3}I)

U.S strategic nuclear forces are intended to deter hostile Soviet actions, and to do so in a way that contributes to international stability. Their ability to meet these objectives depends not only on the character and capabilities of the weapons systems themselves, but also on the character and capability of the supporting C^{3}I systems. Specifically, both deterrence and stability may depend on: 1) the reliability with which a Soviet attack can be detected; 2) the timeliness and quality of the information about such an attack that can be assembled; 3) the speed and reliability with which this information can be communicated to the National Command Authorities; and 4) the immunity to disruption of communications between the National Command Authorities and the strategic forces.

The technical difficulty of making strategic weapons themselves survivable was a major focus of OTA's study of "MX Missile Basing." The problems of assuring the reliability and survivability of the systems that control these weapons are at least as difficult.

The purpose of the study is to assess the technical capabilities and vulnerabilities of present U.S. strategic C^{3}I systems. The study will identify needs and opportunities for improvement in the present systems, with special emphasis on additions to the system that could usefully be made in the near term with available technology. Promising avenues of research for future improvements will also be identified.

In order to carry out a meaningful study in the short time available, the study will be limited to: 1) central strategic forces, excluding European-based nuclear forces or general purpose forces; 2) the period of several hours after launch of the first enemy missile; and 3) situations in which the President is located at the White House, Camp David, or another prepared location at the time the attack begins.

Delivery date: Summer 1982 (Classified). Call 226-2020 for further information.

Requesters: Chairman, Technology Assessment Board. Senate Committee on Appropriations.

HEALTH AND LIFE SCIENCES

Impacts of Technology on Productivity of the Croplands and Rangelands of the United States

Were it not for technological advances, world agriculture would never have been able to keep pace with world population growth. Historically, U.S. technology has had a pronounced positive impact on increasing the productivity of croplands and pastures. U.S. dependence on a continuing supply of renewable natural resources compels it to maintain the stability of the ecological systems from which the resources arise. Now, however, there is increasing documented evidence showing that human activities are straining parts of the biological and physical systems and that the land's productivity is in jeopardy.

This land productivity assessment examines the effect of presently used technologies on the capacity of the cropland and rangeland resource base to sustain high levels of production, and on emerging technologies that might be used to offset adverse effects of some of the established technologies. The assessment includes evaluations of: 1) the adequacy of available data on the effect of technologies on land productivity; and 2) new technologies that have potential for restoring, maintaining, or improving the productivity of the cropland and rangeland resource base. Selected case studies were developed to indicate how society is affected directly and indirectly where long-term productivity of agricultural ecosystems is being altered through innovative applications of technologies.

Delivery date: Early 1982. Call 224-8996 for further information.

Requesters: House Committee on Agriculture. Senate committees: Environment and Public Works; Appropriations.

Water-Related Technologies for Sustaining Agriculture in U.S. Arid and Semiarid Lands

Freshwater is a controlling factor of U.S. agricultural productivity. In recent years, the availability of high-quality freshwater for agriculture, especially in the arid and semiarid United States, has become a major concern. In particular, competition for available water supplies, overdraft of underground aquifers, and deteriorating water quality have contributed to severe water supply problems for arid and semiarid U.S. agricultural lands (those receiving about 20 inches or less of rainfall annually).

The principal farming systems in arid and semiarid U.S. lands are irrigation agriculture, dryland farming, and ranching. Irrigation agriculture is one of the most seriously affected by reduced water supplies. This farming system accounts for over 80 percent of all consumed water withdrawn from streams and underground aquifers. About 90 percent of U.S. irrigated land is in the 17 Western States where water is in short supply. In California, Arizona, New Mexico, Nevada, Utah, Wyoming, and Idaho, for example, over 80 percent of the crops are produced with irrigation. Agricultural water supplies suffer from declining water tables as well as agriculture's inability to compete on the open market for the water that is available. Energy costs become a particular critical factor as water must be transported from greater distances or lifted from deeper aquifers. In addition, many conventional agricultural systems use available water inefficiently. The seriousness of the problem necessitates an assessment of present and emerging water-related technologies and their potential for sustaining arid and semiarid agriculture in the United States.

This assessment will focus on the opportunities of present and emerging technologies to provide long-term sustainable agricultural productivity by increasing efficiency of water use and reducing agricultural water demands in arid and semiarid U.S. lands. The ability of such technologies to improve water quality of agricultural runoff and the associated socioeconomic impacts also will be examined.

Technologies considered will include those that require modification of existing systems to maintain the present style of agriculture and those that involve fundamental changes through the adoption of low-water-demand biological technologies and systems. The assessment will include a critical review of data on the magnitude of the arid/semiarid water problem, potentials for alternative supplies, and possible legal and institutional mechanisms supportive of the adoption of sound agricultural water-related technologies.

Delivery date: Spring 1983. Call 226-2192 for further information.

Requester: House Committee on Agriculture.

Technologies for Sustaining Tropical Forest Resources

Each year 1 to 2 percent of the world's remaining tropical forests are converted to other land uses or to wasteland. Where cleared land is developed for sustained agriculture, deforestation can be beneficial. But most land now being cleared cannot sustain farming or grazing with available technologies, so it is abandoned after a few years. Often the forests do not regrow because of highly weathered soils and harsh climates. Thus, highly productive but underused forest resources are giving way to grasslands and deserts of low productivity.

Deforestation has economic and environmental consequences that jeopardize U.S. imports of agricultural germ plasm, pharmaceuticals, chemical feedstocks, foods, drugs, animals for medical research, tropical hardwoods, and veneer and wood products. Also in jeopardy are U.S.-funded development projects in tropical countries, U.S. migratory wildlife species, and stability of global climates. Tropical deforestation places pressure on world oil supplies and is an important causal factor in the increasing number of refugees seeking U.S. entry.

The U.S. Agency for International Development (AID), the United Nations (U.N.) agencies, and the World Bank have increased funding for forestry severalfold in the past 5 years. American corporations and nonprofit institutions also have been increasingly involved in the search for solutions to tropical deforestation problems. Most importantly, many tropical nations' governments recognize that deforestation constrains their economies and their development options; they are now making institutional changes to slow deforestation and to accelerate reforestation.

The United States is recognized for its leadership in bringing the deforestation problems to world attention and for the technical versatility it has to address the problem. Sustaining tropical forest resources can be helped or hindered by applications of certain technologies. OTA will assess: 1) dimensions of the tropical deforestation problem; 2) impacts of technologies, both conventional and new, that the United States may apply to enhance use and management of forest resources; 3) the role that U.S.-funded agencies, such as AID, Peace Corps, the U.N., and the World Bank, play in developing improved technologies; 4) improved mechanisms for transferring such technologies to tropical nations and to tropical regions of the United States; and 5) the special strengths of U.S. institutions in relevant science and technology.

Delivery date: Spring 1983. Call 226-2192 for further information.

Requesters: House Foreign Affairs Committee. Senate Committee on Energy and Natural Resources.

Evaluation of Veterans Administration Agent Orange Protocol

The epidemiologic study by the Veterans Administration of the long-term health effects resulting from exposure to agent orange was mandated in the Veterans Health Programs Extension and Improvements Act of 1979 (Public Law 96-151). The same law requires OTA to review the study design. An advisory panel was assembled to carry out the review. The panel's first report was made in September 1981.

Delivery date: Indeterminate. Call 226-2070 for further information.

Requester: Mandated by Public Law 96-151.

Strategies for Medical Technology Assessment

Technology assessment is gaining increasing acceptance as a means of rationalizing health care. This trend has been stimulated by the rapidly rising costs of health care and technology's contribution to those costs. Since assessments can be expensive and time-consuming and can result in delaying the diffusion of beneficial technologies, and since not all technological developments can be systematically assessed, it is critical to select: 1) the right technologies to be assessed; 2) the optimum stage of technological development; and 3) the appropriate assessment methods. It is also important for the information gained from assessments to be disseminated in a timely and efficient manner. Currently, there is no coherent Federal policy regarding the selection process, and there are major problems with information dissemination. These issues are critical because many Federal agencies, as well as private organizations and individuals, depend on information from assessments to make decisions.

This study examines the appropriateness and validity of existing assessment methods, such as controlled clinical trials, epidemiological studies, consensus exercises, and computer models, with the intent of identifying alternative strategies for assessment. In addition, the MEDLARS information and retrieval system of the National Library of Medicine is evaluated with respect to the appropriateness of indexing, storage, and retrieval of useful information. The uses of that information by both governmental and private sectors are then examined in relation to the safe, efficacious, and efficient use of medical technologies.

Delivery date: Early 1982. Call 226-2070 for further information.

Requester: House Committee on Energy and Commerce.

Technology and Handicapped People

Approximately 45 million Americans—including 10 million children—have significant mental or physical handicaps. Technologies for aiding handicapped people are numerous, varied, and often complex and expensive. Such technologies are designed to alleviate, eliminate, or prevent the effects of handicapping conditions. They can be used to provide mobility and independence, restore or improve functional abilities, and help enable handicapped individuals to lead more productive and fulfilling lives.

The Federal Government's involvement in this area is extensive. A multitude of programs and agencies develop, evaluate, provide, pay for, and deliver technologies. Other actions—such as civil rights and education opportunity laws—provide conditions and incentives for further development of and investment in technologies for the handicapped.

Yet there are serious questions about whether technologies for the handicapped are being developed and used in as effective and efficient a manner as possible. Inadequate information exists regarding the overall process of technological development and use. Individual aspects of the technological process also remain troublesome. For example, what is the appropriate role for sophisticated technologies as opposed to (or in concert with) the soft areas such as human service delivery systems that ultimately may determine the effectiveness of technologies? What methods exist for assessing the costs and benefits to society or to handicapped individuals of investment in or use of various technologies? What is the state of knowledge in regard to such costs and benefits? What effect will advances in medical technology have on the number and types of handicaps?

This assessment will provide information on general issues, such as the state of the art of evaluating efficacy, safety, and costs. In addition it will address definitional problems and their implications. Most critically, it will examine several theme issues in depth. For example, what are the causes and the effects of today's emphasis on sophisticated technology?

Delivery date: Early 1982. Call 226-2070 for further information.

Requester: Senate Committee on Labor and Human Resources.

Health and Safety Control Technologies in the Workplace

One hundred million Americans work. Each year there are some 2.3 million disabling injuries and 13,200 accidental deaths in the workplace, and perhaps 100,000 people die from job-related diseases. Efforts to reduce this toll involve employers, labor organizations, nonprofit institutions, insurance companies, and Government agencies. To a major extent these efforts are directed at developing and applying control technologies—engineering controls, worker education programs, and personal protection devices.

New industrial plant construction and modernization of existing plants is expected to result from interest in increased productivity and reduced energy consumption. Such construction may offer opportunities for installing new technologies to reduce workplace health and safety hazards.

This assessment would develop information about research and development, diffusion, application, and evaluation of workplace control technologies. Engineering controls, worker education programs, personal devices, and interrelationships between them will be described and their role in worker protection evaluated.

One product of the assessment would be a series of options. These are expected to address:

- improving data about workplace accidents and illnesses,
- aiding development of appropriate technologies, their diffusion, application, and evaluation, and
- making control technologies available to small firms at a price they can afford.

Delivery date: Early 1983. Call 226-2070 for further information.

Requester: House Committee on Energy and Commerce.

World Population and Fertility Planning Technologies: The Next Twenty Years

World population has passed 4.4 billion and is expected to double in 70 years. Growth of this magnitude has major implications for the global biosphere and for international economic and political stability. Because of the consequences of rapid population growth—such as increasing demands for food, energy, and jobs—most governments and international agencies have adopted policies and initiated programs in the last 20 years to modify birth rates.

OTA's study of global population examines how Government policies and programs view planned birth technologies, and how new international population assistance has changed world population growth in the last 20 years. It projects probable impacts of population growth from 1980 to 2000 on food, energy, jobs, income, and other aspects of quality of life; and it assesses present and prospective birth technologies and factors determining their future development and use. The assessment focuses on the Third World, where 92 percent of population growth in the next two decades will occur and where their governments seek to slow growth. It includes a research agenda relevant to their problems and ends with the policy alternatives open to the United States in dealing with world population issues. U.S. domestic population policies are not included in this assessment.

Delivery date: March 1982. Call 224-8996 for further information.

Requester: The OTA Director, with approval of the OTA Congressional Board.

Comparative Assessment of the Commercial Development of Biotechnology

"Biotechnology" refers to the use of biological techniques such as recombinant DNA technology, cell fusion, fermentation, and enzyme technology to produce chemicals, pharmaceuticals, or other substances to act on the environment to increase the quality of life (as in pollution control), or to improve the characteristics of economically important plants and animals. Advantages of biological production over the alternative methods of chemical production or extraction of substances from living tissues include reduced dependence on petroleum substrates or on large quantities of sometimes scarce plant, animal, or human tissues. Estimates or yearly potential markets for substances that could be produced from applications of recombinant DNA technology in just the chemical and pharmaceutical industries are $15 billion and more in the next 20 years.

The potential of biotechnology has stimulated a great deal of corporate activity in the United States in the last 2 years. Many new small firms have been formed and large corporations are developing capability in biotechnology. Foreign activity in the field is intense, especially in Japan, West Germany, France, and the U.S.S.R.

This assessment will evaluate whether biotechnology and associated research and development are developing in the United States in such a way that this Nation is likely to be in a competitive position with other nations in the years ahead. The keys to competitive development of the biotechnology industry in the United States are basic research and the transfer of basic research into commercial application. One major influence on development of the industry in the United States is Government policies on funding of research, patents, health and safety regulations, antitrust laws, and taxation. Equally important and significantly influenced by Government policy are industrial/academic relationships and their influence on funding, research, manpower training, and information flow. New developments in the technology and in support technologies are important to the growth of the industry and will also be examined as part of this assessment. Analysis along the same dimensions as those above will be conducted for selected other countries in order to estimate the probable U.S. position in the biotechnology industry in the next 10 years.

It is also important to consider areas of application in the public interest. Attractive commercial applications may so engage industry that some areas, of great public benefit but higher commercial risk, could languish. The possible Government role in such areas will be investigated.

Delivery date: Interim Report, spring 1982; Full Report, summer 1983. Call 226-2090 for further information.

Requesters: House Committee on Science and Technology. Senate Committee on Commerce, Science, and Transportation.

Genetic Screening and Cytogenetic Surveillance in the Workplace

One of the most difficult problems in regulatory policymaking is determining what is a safe level of exposure to chemicals in the workplace. For any particular chemical, the scientific evidence on risk is often conflicting, and the cost of each incremental lowering of exposure levels becomes increasingly expensive. Further, because of the natural variability of humans, what may be safe for one person, or even the vast majority of people, may be hazardous to another. Accordingly, some occupational health specialists have advocated both genetic screening and cytogenetic surveillance of workers as a means of identifying high-risk individuals and environments where the entire work force may be at risk. The use of these techniques is controversial because the ability to actually identify high-risk workers is a matter of scientific dispute and the identification of such workers, if possible, could place their interests in opposition to those of the company.

This assessment will examine the following questions: What is the technological state of the art? Do the claimed associations in fact exist between certain recessive genes or chromosomal abnormalities and increased risk of harm from certain chemicals? If these associations exist, do genetic screening and cytogenetic surveillance offer a cost-effective way to enhance worker health and safety, given the economic and technical fact of life that workers will face some exposure to chemicals? What are the alternatives, regulatory or otherwise? What responsibilities might companies have toward high-risk workers? How might these tests be done in order to protect the interests of all parties?

Four specific conditions for which screening tests are available will be examined in detail. They are G-6-PD deficiency, methemoglobin reductase deficiency, alpha-1—antitrypsin deficiency, and aryl hydrocarbon hydroxylase inducibility.

Delivery date: Summer 1982. Call 226-2090 for further information.

Requester: House Committee on Science and Technology.

SCIENCE, INFORMATION, AND NATURAL RESOURCES

Radiofrequency Use and Management: Impacts From the World Administrative Radio Conference of 1979

More than 150 nations' representatives met in Geneva, Switzerland, for 11 weeks in late 1979 to review and adjust the global allocation of uses of the radio magnetic spectrum. This major world meeting changed frequency allocations, adopted new definitions, planned additional future world and regional conferences, and modified the international radio regulations of the International Telecommunication Union (ITU). This study reviews the U.S. preparations for and participation in that conference, identifies its major results and projects their impacts, and looks at the future role of ITU and the U.S. participation in ITU and such future conferences.

Delivery date: Early 1982. Call 224-8996 for further information.

Requester: Senate Committee on Commerce, Science, and Transportation.

Societal Impact of National Information Systems

The National Information Systems project includes three information system case studies and an overview study. The overview study examined the use of computer technology in national information systems, computer-related public policy issues that Congress is likely to face over the next few years, and key trends in the underlying technology and industry structure. The case study on computerized criminal history (CCH) records assesses the major issues and impacts associated with the principal alternatives for a national CCH system. The case study on electronic message systems (EMS) examines the impacts of EMS on the mailstream and on a possible U.S. Postal Service role in electronic mail. The case study on electronic funds transfer (EFT) analyzes the possible impacts of EFT on privacy, security, and equity.

Delivery date: Overview study published October 1981. EFT, EMS, and CCH case studies, early 1982. Call 226-2240 for further information.

Requesters: Senate Committee on the Judiciary. House committees: Judiciary; Post Office and Civil Service.

The Patent System and New Technological Enterprises

The climate for generating new technologically based enterprises in the United States has worsened during the past decade. Economists differ in their appraisals of the exact contribution such firms make to innovation, employment, and economic progress; however, it is possible that the contribution level is high and that technologically based enterprises are essential to the growth and revitalization of our society. Fledgling entrepreneurs and independent innovators are frequently dependent on, and influenced by, the patent system to a much greater degree than are large, established firms. In almost all aspects of the patent system—e.g., prosecution, interferences, licensing, litigation—small firms and individual inventors face far more difficult obstacles and economic choices than do the large firms. The importance of new technologically based firms to the future economic vitality of the United States underscores the need to assess the impact of the patent system on the generation and stimulation of such enterprises.

Delivery date: Summer 1982. Call 226-2249 for further information.

Requesters: House committees: Small Business; Judiciary. Senate Committee on the Judiciary.

Information Technology and Education

Over the last decade, the educational system has been increasingly pressed to meet a variety of new needs on a constant or even shrinking budget. The Federal and State governments now require that schools provide equal educational opportunities to groups traditionally outside the mainstream, such as the handicapped. Changing needs for job skills and changing demographic conditions also present new demands for education and training beyond the ages traditionally considered as the educational years. Information technology potentially provides opportunities for education systems to improve productivity and quality of instruction, and to offer more flexibility both in content, and in the time and place of offering. Previous attempts to enlist technology in education have had mixed outcomes, but the markedly lower cost and increased capability of new and projected computer technology, coupled with advances in telecommunication services, imply the need for a new look at educational use of technologies. The study will identify and project relevant technology and R&D activity, and the providers and users of curricula, and educational technology, and assess the likely impacts of selected alternative policies on the use of information technology.

Delivery date: Spring 1982. Call 226-2240 for further information.

Requester: House Committee on Education and Labor.

The Use of Models for Freshwater Resources Management: Planning and Policy

Our Nation's water resource policies affect many domestic problems in the United States today—food production, energy, regional economic development, environmental quality, even our international balance of trade. As the country grows, and excess water supplies diminish, it becomes increasingly important to manage existing supplies with the greatest possible efficiency. In recent years, successful management and planning of water resources has increasingly been based on the results of mathematical models.

The OTA study of water resource models is not an assessment of mathematical equations or computers, but of the Nation's ability to use models to more efficiently and effectively analyze and solve our water resource problems. The assessment considers not only the usefulness of the technology—the models—but the ability of the Federal and State water resource agencies to effectively apply these analytic tools.

The capabilities of water resource models vary greatly from issue to issue. In a number of areas, further research and development is needed, but in other areas, usable and reliable tools currently exist. However, as often occurs, these technologies have outstripped the capabilities of Federal, State, and local agencies to support and effectively use them. Today, model use is increasing the efficiency and lowering the cost of water resource management, but the potential for further improvement remains great.

The OTA report presents options which focus on ways of improving Federal, State, and local use of available technologies to analyze and resolve water resource problems.

Delivery date: In press. Call 226-8996 for further information.

Requester: House Committee on Interior and Insular Affairs.

High-Level Radioactive Waste Management and Disposal

More than three decades into the nuclear age, this country still has no permanent disposal facilities for commercial high-level radioactive waste. This assessment focuses on technologies for disposal of commercial high-level waste (spent fuel or solidified waste from reprocessing). A clear understanding of the problem of managing radioactive waste from its generation to final disposal requires comprehensive analysis of the interactive relationships among possible storage and disposal technologies; transportation systems; regulatory considerations; and Federal, State, and local jurisdictional prerogatives. The OTA study is using a systems analysis technique to evaluate a range of strategies for developing and deploying a commercial high-level radioactive waste disposal system. Other waste forms are considered to the extent needed to determine how their management and disposal will affect commercial high-level waste disposal plans and to provide a basis for analysis for the impacts of, and management problems presented by, a full-scale waste disposal system.

Delivery date: Early 1982. Call 226-2132 for further information.

Requesters: House committees: Merchant Marine and Fisheries; Science and Technology; Foreign Affairs. Senate committees: Energy and Natural Resources; Commerce, Science, and Transportation.

Impacts of Atmospheric Alterations

Many present-day human activities—particularly the burning of fossil-fuels—are altering the Earth's atmosphere in potentially harmful ways. The precise nature and extent of such activities are unclear.

However, the potential consequences are severe enough to merit careful congressional consideration of domestic and international Federal policies.

Some of the consequences, such as acid rain, are occurring today. Others, such as global climate changes due to increasing carbon dioxide concentration, may appear within the next century. Increasing sulfur and nitrogen oxides and their transformation products (acid rain and oxidants) may damage thousands of lakes, decrease crop and forest productivity, deplete soil nutrients, damage buildings and monuments, and have adverse effects on human health.

The assessment will characterize the potential benefits of acting now to abate long-range transport air pollution and the potential costs of action that may be premature. The study will: 1) identify the resources potentially at risk, as well as the societal concerns about the loss of these resources; and 2) identify broad pollution control strategies, and discuss their costs, potential effectiveness, and societal effects. OTA will develop a range of plausible, regionally oriented impact scenarios that describe the potential environmental and social consequences of transported pollutants, and actions that might be taken to control them. These scenarios will not attempt to "forecast" the future, but instead, present a range of plausible consequences of these changes, in terms responsive to near-term congressional decisions.

Delivery date: Summer 1982. Call 226-2131 for further information.

Requesters: House Committee on Energy and Commerce. Senate Committee on Environment and Public Works.

Assessment of Approaches to Wetlands Use

Both the development and the preservation of wetlands—swamp, marshes, bogs, and other areas that are periodically saturated with water —offer benefits to individual users of wetlands as well as to society as a whole. For example, when drained or filled, some wetlands may be converted into highly productive farmland or choice residential or commercial property. Valuable oil, gas, and timber resources may also be extracted from some wetland areas. Many other technological activities, such as the construction of dams, levees, breakwaters and jetties, and bridges and highways, often take place in wetlands. Similarly, undeveloped wetlands may provide flood control, fish and wildlife habitat, erosion protection, pollution control, and ground water recharge.

In the past, the values of undeveloped wetlands have largely been ignored or seen as less than those of developed or technologically modified wetlands. As a result, approximately 30 percent of the Nation's original wetlands have been modified in some way by various technological activities. During the last decade, the importance of the natural functions of wetlands has received increasing recognition. In response to concerns about wetlands, many Federal and State laws now influence the development and regulate the use of wetlands through measures such as acquisition, economic incentives, and permitting.

Proposals to develop wetlands have frequently led to controversy. To provide a framework for future debates on this issue, OTA will evaluate:

- the effects of technological activities on wetlands,
- technological and nontechnological options for mitigating undesired impacts,
- the functional values of different types of wetlands,
- problems associated with weighing the benefits of technological activities in wetland areas against the functional values of the wetlands that may be lost, and
- various approaches to wetlands use.

Delivery date: Early 1983. Call 226-2130 for further information.

Requester: Senate Committee on Environment and Public Works.

Space Policy and Applications

The assessment explores the adequacy of the Nation's present and future civilian space technology base. It examines the possible reliance on that base for applications of space technology in the 1980-2000 time frame. The focus will be on current and anticipated uses and management of remote sensing, communications satellites, materials processing in space, and the utilization of the space transportation system. A range of program and policy options will be developed, together with their societal, institutional, and economic implications. International impacts and cooperation and the U.S. space technology-based competitive position will also be considered. The study has cross-cutting ties to the ongoing OTA assessments of solar power satellites, land productivity, and telecommunications, each with important space technology facets.

Delivery date: Early 1982. Call 226-2209 for further information.

Requesters: Senate Committee on Commerce, Science and Transportation. House Committee on Science and Technology.

Global Models, World Futures, and Public Policy—A Critique

The purpose of this assessment is to examine global models as a tool for long-range strategic analysis and policy development. The findings and recommendations of five major modeling studies, including Global 2000, are compared and evaluated.

Delivery date: Early 1982. Call 224-8996 for further information.

Requester: OTA's Congressional Board.

Technological Innovation and Health, Safety, and Environmental Regulations

This assessment examines the effects of health, safety, and environmental regulation on the rate of productivity growth and on technological innovation in several sectors of the economy. The study also examines alternative regulatory policies with regard to their likely effects on private sector innovation.

Delivery date: Early 1982. Call 224-8996 for further information.

Requester: Senate Committee on Commerce, Science, and Transportation.

Impact of Advanced Air Transport Technology

This assessment examines the impact of introducing or not introducing advanced high-speed aircraft into our future commercial fleet and of other potential commercial aircraft developments. The assessment is being conducted in four parts: 1) advanced high-speed aircraft (completed), which examines the economic, energy, environmental, and societal impacts of introducing advanced subsonic and/or supersonic aircraft into the future commercial fleet; 2) air cargo systems, which studies the role, importance and impact of advanced aircraft technology on the air cargo systems; 3) air service to small communities, which is an inquiry into recent trends in air service to small communities and the possible influence of advances in commuter aircraft technologies on this service; and 4) program management and financing alternatives of advanced high-speed aircraft, which examines alternative means for financing and managing the development and production of an advanced supersonic or subsonic commercial air transport.

Delivery dates: Part 1, published April 1980; Part 2 (in press); Part 3 (in press); Part 4, early 1982. Call 226-2182 for further information.

Requesters: House Committee on Science and Technology. Senate Committee on Commerce, Science, and Transportation.

Airport and Air Traffic Control System

Increasing levels of air traffic have led to problems of congestion and delay at many of the Nation's large hub airports, and continued growth of commercial and general aviation will spread these problems to other airports in the future. The rate and incidence of growth will be affected by a number of factors—such as general economic conditions and the future evolution of the deregulated airline industry—that are difficult if not impossible to foresee. There are, however, a number of steps that might be taken to alleviate these problems by increasing the effective capacity of the airport and air traffic control (ATC) systems. Potential ATC system components include enroute automation, collision avoidance, data link, and microwave landing system. The Federal Aviation Administration (FAA) currently plans to spend $2.4 billion for enroute computer modernization alone over the next decade, and users will have to spend billions more for equipment to operate in this new environment. Airport traffic-management alternatives include a number of proposals for increasing the efficiency with which airport facilities are used, such as reliever airports, peakhour landing fees, stub runways, and automated terminal area metering. This assessment examines the likely future evolution of domestic aviation and examines both the FAA's proposals and other alternatives for meeting the increasing demand for airport and ATC services through the year 2000.

Delivery date: Early 1982. Call 226-2200 for further information.

Requesters: House Committee on Appropriations. Senate Committee on Commerce, Science, and Transportation.

Section IV.—Organization and Operations

Created by the Technology Assessment Act of 1972 (86 Stat. 797), OTA is a part of and is responsible to the legislative branch of the Federal Government. OTA received funding in November 1973 and began operations as the second session of the 93d Congress convened in January 1974.

The act provides for a bipartisan Congressional Board, a Director, and such other employees and consultants as may be necessary to conduct the Office's work.

The Congressional Board is made up of six Senators, appointed by the President pro tempore of the Senate, and six Representatives, appointed by the Speaker of the House, evenly divided by party. In 1981, Sen. Ted Stevens (R-Alaska) and Cong. Morris Udall (D-Arizona) served as the Chairman and Vice Chairman, respectively, of the Board. The two posts alternate between the Senate and House with each Congress. The Board members from each House select their respective officer.

The Congressional Board sets the policies of the Office and is the sole and exclusive body governing OTA. The Board appoints the Director, who is OTA's chief executive officer, and a nonvoting member of the board.

The act also calls for a Technology Assessment Advisory Council comprised of 10 public members eminent in scientific, technological, and educational fields, the Comptroller General of the United States, and the Director of the Congressional Research Service of the Library of Congress. The Advisory Council advises the Board and the Director on such matters as the balance, comprehensiveness, and quality of OTA's work, and OTA's nongovernmental resources.

In providing assistance to Congress, OTA is to: identify existing or probable impacts of technology or technological programs; where possible, ascertain cause-and-effect relationships of the applications of technology; identify alternative technological methods of implementing specific actions; identify alternative programs for achieving requisite goals; estimate and compare the impacts of alternative methods and programs; present findings of completed analyses to the appropriate legislative authorities; identify areas where additional research or data collection is required to provide support for assessments; and undertake such additional associated activities as may be necessary.

INITIATION, PROCESSING, AND FLOW OF ASSESSMENTS

OTA's primary function is to provide congressional committees with assessments or studies that identify the range of probable consequences, social as well as physical, of policy alternatives affecting the uses of technology. Requests for OTA assessments may be initiated by:

- the chairman of any standing, special, select, or joint committee of Congress, acting alone, at the request of the ranking minority member, or a majority of the committee members;
- the OTA Board; or
- the OTA Director, in consultation with the Board.

The authorization of specific assessment projects and the allocation of funds for their performance is the responsibility of the OTA Board. The Board early establishes priority areas of study, and approves individual assessment projects within those areas. To help in making these decisions, the Board considers recommendations and plans developed by OTA staff, and applies the following general selection criteria developed in consultation with the Advisory Council:

- Is this now or likely to become a major national issue?
- Can OTA make a unique contribution, or could the requested activity be done effectively by the requesting committee or another agency of Congress?
- How significant are the costs and benefits to society of the various policy options involved, and how will they be distributed among various affected groups?
- Is the technological impact irreversible?
- How imminent is the impact?
- Is there sufficient available knowledge to assess the technology and its consequences?
- Is the assessment of manageable scope—can it be bounded within reasonable limits?
- What will be the cost of the assessment?
- How much time will be required to do the assessment?
- What is the likelihood of congressional action in response to this assessment?
- Would this assessment complement or detract from other OTA projects?

Assessment reports emerge from the combined effort of a staff with appropriate expertise, citizen advisory panels of experts, consultants, contractors, and other congressional information agencies. A particular assessment project may involve exploratory meetings, workshops of advisory panels, staff analyses, and consultant studies.

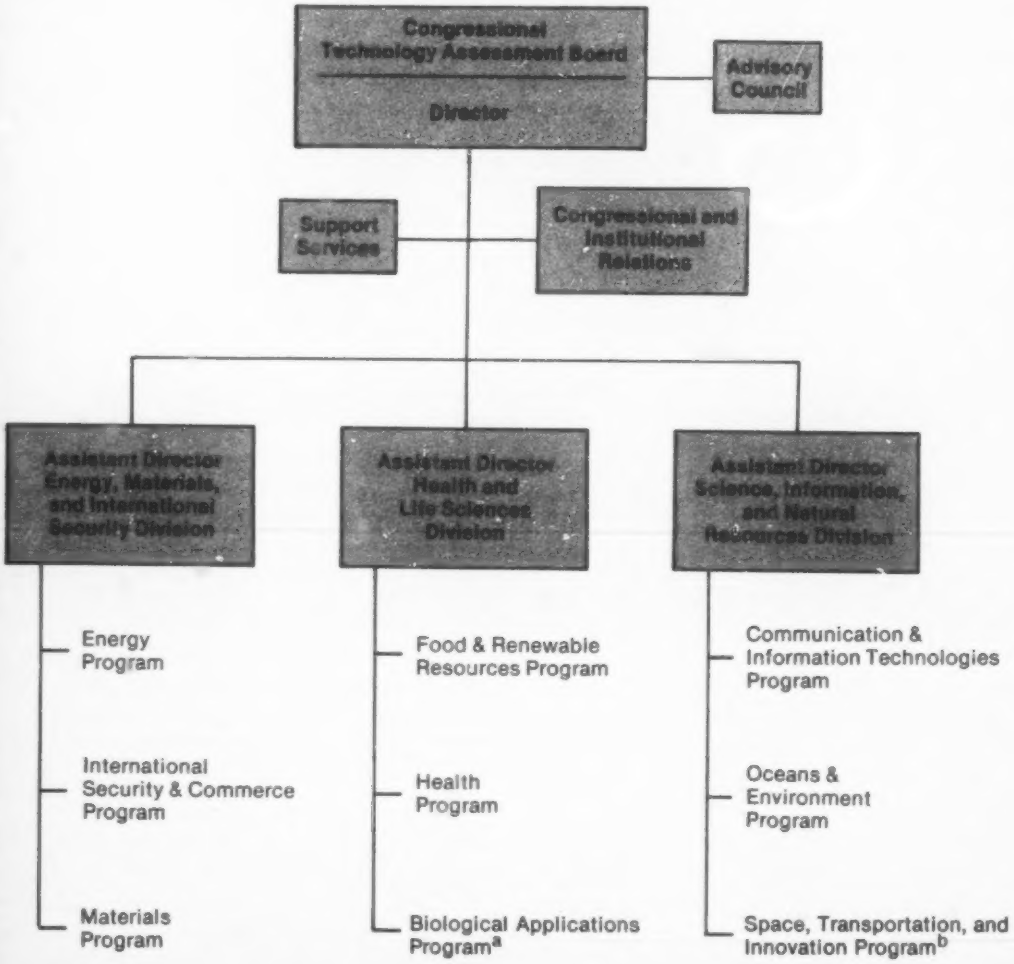
Different approaches are used. The method employed, personnel involved, and the skills tapped depend on the technology under study, the requesting client, the nature of the issues at stake, and the time available for and the setting of the project. Required to consider the needs of Congress, the vast range of technological issues, and the resources available for a study, OTA remains flexible in its assessment methods.

All OTA assessments strive to be objective, fair, nonpartisan, and authoritative. They must also be timely so as to meet congressional schedules.

ORGANIZATIONAL STRUCTURE

The Office is organized into three operating divisions, each headed by an assistant director. The three divisions are Energy, Materials, and International Security; Health and Life Sciences; and Science, Information, and Natural Resources. They encompass assessments grouped in the areas of energy, food and renewable resources, human resources, health, materials, international security and commerce, oceans and environment, communication and information technologies, and space technology. See chart detailing OTA's organizational structure.

OTA Organization Chart


Congressional Technology Assessment Board
Director
Advisory Council
Support Services
Congressional and Institutional Relations
Assistant Director Energy, Materials, and International Security Division
Assistant Director Health and Life Sciences Division
Assistant Director Science, Information, and Natural Resources Division
Energy Program
International Security & Commerce Program
Materials Program
Food & Renewable Resources Program
Health Program
Biological Applications Program[a]
Communication & Information Technologies Program
Oceans & Environment Program
Space, Transportation, and Innovation Program[b]

[a] Changed from Human Resources Program, March 1982.
[b] Changed from Space Technology Program, March 1982.

Staff professionals represent a wide range of disciplines and backgrounds, including the physical, biological, and environmental sciences, engineering, social sciences, law, and public administration. Professionals from executive branch agencies, detailed to OTA on a temporary basis, and participants in several congressional fellowship programs also contribute to the work of the Office.

Private Sector Involvement

The private sector is heavily involved in OTA studies as a source of expertise and perspectives while an assessment is in progress. Contractors and consultants are drawn from industry, universities, private research organizations, and public interest groups.

OTA works to ensure that the views of the public are fairly reflected in its assessments. OTA involves the public in many ways—through advisory panels, workshops, surveys, and formal and informal public meetings. These interactions provide citizens with access to information and help OTA identify contrasts between the perspectives of technically trained and lay citizens.

OPERATIONS

Publishing Activities

During 1981, OTA delivered 53 published documents to Congress. These included: 14 assessment reports; 11 summaries; 16 background papers; 3 technical memorandums; 3 working papers (appendixes); 2 staff papers; and 4 administrative reports. In addition, OTA had input in the preparation of a committee print on "Background Papers for Innovative Biological Technologies for Lesser Developed Countries" for the House Committee on Foreign Affairs.

Requests for Publications

The Publishing Office processed over 21,303 (averaging 58.4/day) separate mail and phone requests for OTA publications during the calendar year. Of this total, 2,219 were requests from congressional offices, and 19,084 requests from various Government agencies and the private sector.

Private Sector Reprinting

To date, 24 OTA publications (in whole or in part) have been reprinted, by commercial publishers or private organizations for various audiences. Out of the 24 reprinted publications, three publications (*Energy From Biological Processes*, vol. II, *The Effects of Nuclear War*, and *Impacts of Applied Genetics*) have been reprinted by more than one commercial publisher. Among the publications reprinted are:

- *Westview Press*
  - Impacts of Applied Genetics: Micro-Organisms, Plants, and Animals
  - Assessment of Technologies for Determining Cancer Risks From the Environment
  - Energy from Biological Processes, Vol. I
  - Technology and Soviet Energy Availability
- *Praeger Publishing Co.*
  - Nulcear Proliferation and Safeguards
- *Ballinger Publishing Co.*
  - The Direct Use of Coal: Prospects and Problems of Production and Combustion
  - Energy From Biological Processes, Vol. II: Technical and Environmental Analyses
- *McGraw Hill*
  - Enhanced Oil Recovery Potential in the United States
  - An Assessment of Oil Shale Technologies
  - Energy From Biological Processes, Vol. II: Technical and Environmental Analyses
  - World Petroleum Availability: 1980-2000—A Technical Memorandum
- *Allanheld, Osmun Publishing Co.*
  - Technology and East West Trade
  - The Effects of Nuclear War
  - Residential Energy Conservation, Vol. 1
- *Olympus Corp.*
  - The Implications of Cost-Effectiveness Analysis of Medical Technology, Background Paper #2, Case Study #5: Periodontal Disease: Assessing the Effectiveness and Costs of the Keyes Technique
- *The Society for Microbiology*
  - Impacts of Applied Genetics: Micro-Organisms, Plants, and Animals—Summary

- *Smith Kline Corp.*
  The Implications of Cost Effectiveness of Medical Technology, Background Paper #2, Case Study #11: Benefit and Cost Analysis of Medical Interventions: The Case of Cimetidine and Peptic Ulcer Disease

- *National Association of Medical Directors of Respiratory Care*
  The Implications of Cost Effectiveness of Medical Technology, Background Paper #2, Case Study #12: Assessing Selected Respiratory Therapy Modalities: Trends and Relative Costs in the Washington, D.C. Area

- *Cheshire Books*
  The Effects of Nuclear War

- *Friends of the Earth*
  Energy From Biological Processes—Summary

- *University of American Medical Students, Department of Family and Community Medicine*
  Forecast of Physicians Supply and Requirements

- *Federal Emergency Management Agency*
  The Effects of Nuclear War

International Interests

The United States International Communication Agency published an abridgement of Chapter 2, Introduction "Concepts of Appropriate Technology" from OTA's publication *An Assessment of Technology for Local Development* in a magazine published three times a year in both Spanish and English. Additionally, Asahi Shimbun Publications, Japan's leading newspaper publishing company, had requested permission to translate and publish OTA's publication *Impacts of Applied Genetics: Micro-Organisms, Plants, and Animals.* The translation will be done by researchers specialized in this field at Tsukuba University —one of Japan's most authoritative universities—and staff members of the Science Department of Asahi Shimbun.

Sales of Publications

Government Printing Office.—Sales of OTA publications by the Superintendent of Documents are continuing to be quite popular with the public.

The Superintendent of Documents sold 26,206 OTA reports for an estimated gross income of $200,000 for the period January 1 through December 31, 1981.

Summary of Sales of OTA Publications Through the Superintendent of Documents, GPO (July 1976 through December 1981)

	As of 12/80	As of 12/81	12 mos. difference
Number of individual titled publications put on sale to the public	105	138	+33
Total number sold	124,789	150,995	+26,206
Estimated GPO gross receipts from sales[a]	$551,379	$749,442	+$198,063

[a] Based on a single copy selling price.

National Technical Information Service.—NTIS sells scientific reports and papers that are, generally, not in great demand but are useful for scientific researchers. NTIS is the outlet for OTA's assessment working papers and contractor reports, plus those reports that are out of print by GPO.

Summary of Sales of OTA Publications Through the National Technical Information Service (July 1976 through December 1981)

	As of 12/80		As of 12/81	
Number of individual titled publications put on sale to the public		102		143
Total number sold (hard copy)	5,200	16,171	6,329	20,147
(microfiche)	10,971		13,818	
Estimated NTIS gross receipts from sales		$77,183		$112,435

Organizational Roster of OTA Staff as of December 1981

OFFICE OF THE DIRECTOR

John H. Gibbons, *Director*
Sue Bachtel, *Executive Assistant*
Barbara O'Bryan, *Secretary*

Congressional and Institutional Relations

Marvin Ott, *Director CIR*
Eugenia Ufholz, *Assistant to Director CIR*
Patricia Halley, *Secretary*

Medical Services

Rose McNair, *Resident Nurse*

ENERGY, MATERIALS, AND INTERNATIONAL SECURITY DIVISION

Skip Johns, *Assistant Director*
Teri Miles, *Division Assistant*

Energy Program

Richard Rowberg, *Program Manager*
Thomas Bull, *Project Director*
Virginia Chick, *Secretary*
Alan Crane, *Project Director*
Marian Grochowski, *Secretary*
Nancy Naismith, *Project Director*
Steve Plotkin, *Senior Analyst*
Mary Procter, *Project Director*
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Appendix B
OTA Act

Public Law 92-484
92nd Congress, H. R. 10243
October 13, 1972

An Act

To establish an Office of Technology Assessment for the Congress as an aid in the identification and consideration of existing and probable impacts of technological application; to amend the National Science Foundation Act of 1950; and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Technology Assessment Act of 1972".

Technology Assessment Act of 1972.

FINDINGS AND DECLARATION OF PURPOSE

SEC. 2. The Congress hereby finds and declares that:

(a) As technology continues to change and expand rapidly, its applications are—

(1) large and growing in scale; and

(2) increasingly extensive, pervasive, and critical in their impact, beneficial and adverse, on the natural and social environment.

(b) Therefore, it is essential that, to the fullest extent possible, the consequences of technological applications be anticipated, understood, and considered in determination of public policy on existing and emerging national problems.

(c) The Congress further finds that:

(1) the Federal agencies presently responsible directly to the Congress are not designed to provide the legislative branch with adequate and timely information, independently developed, relating to the potential impact of technological applications, and

(2) the present mechanisms of the Congress do not and are not designed to provide the legislative branch with such information.

(d) Accordingly, it is necessary for the Congress to—

(1) equip itself with new and effective means for securing competent, unbiased information concerning the physical, biological, economic, social, and political effects of such applications; and

(2) utilize this information, whenever appropriate, as one factor in the legislative assessment of matters pending before the Congress, particularly in those instances where the Federal Government may be called upon to consider support for, or management or regulation of, technological applications.

ESTABLISHMENT OF THE OFFICE OF TECHNOLOGY ASSESSMENT

SEC. 3. (a) In accordance with the findings and declaration of purpose in section 2, there is hereby created the Office of Technology Assessment (hereinafter referred to as the "Office") which shall be within and responsible to the legislative branch of the Government.

Technology Assessment Board.

(b) The Office shall consist of a Technology Assessment Board (hereinafter referred to as the "Board") which shall formulate and promulgate the policies of the Office, and a Director who shall carry out such policies and administer the operations of the Office.

Duties.

(c) The basic function of the Office shall be to provide early indications of the probable beneficial and adverse impacts of the applications of technology and to develop other coordinate information which may assist the Congress. In carrying out such function, the Office shall:

(1) identify existing or probable impacts of technology or technological programs;

(2) where possible, ascertain cause-and-effect relationships;

(3) identify alternative technological methods of implementing specific programs;

(4) identify alternative programs for achieving requisite goals;

(5) make estimates and comparisons of the impacts of alternative methods and programs;

(6) present findings of completed analyses to the appropriate legislative authorities;

(7) identify areas where additional research or data collection is required to provide adequate support for the assessments and estimates described in paragraph (1) through (5) of this subsection; and

(8) undertake such additional associated activities as the appropriate authorities specified under subsection (d) may direct.

(d) Assessment activities undertaken by the Office may be initiated upon the request of:

(1) the chairman of any standing, special, or select committee of either House of the Congress, or of any joint committee of the Congress, acting for himself or at the request of the ranking minority member or a majority of the committee members;

(2) the Board; or

(3) the Director, in consultation with the Board.

Information, availability.

(e) Assessments made by the Office, including information, surveys, studies, reports, and findings related thereto, shall be made available to the initiating committee or other appropriate committees of the Congress. In addition, any such information, surveys, studies, reports, and findings produced by the Office may be made available to the public except where—

(1) to do so would violate security statutes; or

(2) the Board considers it necessary or advisable to withhold such information in accordance with one or more of the numbered paragraphs in section 552(b) of title 5, United States Code.

81 Stat. 54.

TECHNOLOGY ASSESSMENT BOARD

Membership.

SEC. 4. (a) The Board shall consist of thirteen members as follows:

(1) six Members of the Senate, appointed by the President pro tempore of the Senate, three from the majority party and three from the minority party;

(2) six Members of the House of Representatives appointed by the Speaker of the House of Representatives, three from the majority party and three from the minority party; and

(3) the Director, who shall not be a voting member.

Vacancies.

(b) Vacancies in the membership of the Board shall not affect the power of the remaining members to execute the functions of the Board and shall be filled in the same manner as in the case of the original appointment.

Chairman and vice chairman.

(c) The Board shall select a chairman and a vice chairman from among its members at the beginning of each Congress. The vice chairman shall act in the place and stead of the chairman in the absence of the chairman. The chairmanship and the vice chairmanship shall alternate between the Senate and the House of Representatives with each Congress. The chairman during each even-numbered Congress shall be selected by the Members of the House of Representatives on the Board from among their number. The vice chairman during each

Congress shall be chosen in the same manner from that House of Congress other than the House of Congress of which the chairman is a Member.

(d) The Board is authorized to sit and act at such places and times during the sessions, recesses, and adjourned periods of Congress, and upon a vote of a majority of its members, to require by subpena or otherwise the attendance of such witnesses and the production of such books, papers, and documents, to administer such oaths and affirmations, to take such testimony, to procure such printing and binding, and to make such expenditures, as it deems advisable. The Board may make such rules respecting its organization and procedures as it deems necessary, except that no recommendation shall be reported from the Board unless a majority of the Board assent. Subpenas may be issued over the signature of the chairman of the Board or of any voting member designated by him or by the Board, and may be served by such person or persons as may be designated by such chairman or member. The chairman of the Board or any voting member thereof may administer oaths or affirmations to witnesses. Meetings. Subpena.

DIRECTOR AND DEPUTY DIRECTOR

SEC. 5. (a) The Director of the Office of Technology Assessment shall be appointed by the Board and shall serve for a term of six years unless sooner removed by the Board. He shall receive basic pay at the rate provided for level III of the Executive Schedule under section 5314 of title 5, United States Code. Appointment. Compensation. 83 Stat. 863.

(b) In addition to the powers and duties vested in him by this Act, the Director shall exercise such powers and duties as may be delegated to him by the Board.

(c) The Director may appoint with the approval of the Board, a Deputy Director who shall perform such functions as the Director may prescribe and who shall be Acting Director during the absence or incapacity of the Director or in the event of a vacancy in the office of Director. The Deputy Director shall receive basic pay at the rate provided for level IV of the Executive Schedule under section 5315 of title 5, United States Code.

(d) Neither the Director nor the Deputy Director shall engage in any other business, vocation, or employment than that of serving as such Director or Deputy Director, as the case may be; nor shall the Director or Deputy Director, except with the approval of the Board, hold any office in, or act in any capacity for, any organization, agency, or institution with which the Office makes any contract or other arrangement under this Act. Employment restriction.

AUTHORITY OF THE OFFICE

SEC. 6. (a) The Office shall have the authority, within the limits of available appropriations, to do all things necessary to carry out the provisions of this Act, including, but without being limited to, the authority to—

(1) make full use of competent personnel and organizations outside the Office, public or private, and form special ad hoc task forces or make other arrangements when appropriate;

(2) enter into contracts or other arrangements as may be necessary for the conduct of the work of the Office with any agency or instrumentality of the United States, with any State, territory, Contracts.

or possession or any political subdivision thereof, or with any person, firm, association, corporation, or educational institution, with or without reimbursement, without performance or other bonds, and without regard to section 3709 of the Revised Statutes (41 U.S.C. 5);

(3) make advance, progress, and other payments which relate to technology assessment without regard to the provisions of section 3648 of the Revised Statutes (31 U.S.C. 529);

(4) accept and utilize the services of voluntary and uncompensated personnel necessary for the conduct of the work of the Office and provide transportation and subsistence as authorized by section 5703 of title 5, United States Code, for persons serving without compensation; 80 Stat. 499; 83 Stat. 190.

(5) acquire by purchase, lease, loan, or gift, and hold and dispose of by sale, lease, or loan, real and personal property of all kinds necessary for or resulting from the exercise of authority granted by this Act; and

(6) prescribe such rules and regulations as it deems necessary governing the operation and organization of the Office.

Recordkeeping. (b) Contractors and other parties entering into contracts and other arrangements under this section which involve costs to the Government shall maintain such books and related records as will facilitate an effective audit in such detail and in such manner as shall be prescribed by the Office, and such books and records (and related documents and papers) shall be available to the Office and the Comptroller General of the United States, or any of their duly authorized representatives, for the purpose of audit and examination.

(c) The Office, in carrying out the provisions of this Act, shall not, itself, operate any laboratories, pilot plants, or test facilities.

Agency cooperation. (d) The Office is authorized to secure directly from any executive department or agency information, suggestions, estimates, statistics, and technical assistance for the purpose of carrying out its functions under this Act. Each such executive department or agency shall furnish the information, suggestions, estimates, statistics, and technical assistance directly to the Office upon its request.

Personnel detail. (e) On request of the Office, the head of any executive department or agency may detail, with or without reimbursement, any of its personnel to assist the Office in carrying out its functions under this Act.

(f) The Director shall, in accordance with such policies as the Board shall prescribe, appoint and fix the compensation of such personnel as may be necessary to carry out the provisions of this Act.

ESTABLISHMENT OF THE TECHNOLOGY ASSESSMENT ADVISORY COUNCIL

Membership. SEC. 7. (a) The Office shall establish a Technology Assessment Advisory Council (hereinafter referred to as the "Council"). The Council shall be composed of the following twelve members:

(1) ten members from the public, to be appointed by the Board, who shall be persons eminent in one or more fields of the physical, biological, or social sciences or engineering or experienced in the administration of technological activities, or who may be judged qualified on the basis of contributions made to educational or public activities;

(2) the Comptroller General; and

(3) the Director of the Congressional Research Service of the Library of Congress.

Duties.

(b) The Council, upon request by the Board, shall—

(1) review and make recommendations to the Board on activities undertaken by the Office or on the initiation thereof in accordance with section 3(d);

(2) review and make recommendations to the Board on the findings of any assessment made by or for the Office; and

(3) undertake such additional related tasks as the Board may direct.

Chairman and Vice Chairman.

(c) The Council, by majority vote, shall elect from its members appointed under subsection (a)(1) of this section a Chairman and a Vice Chairman, who shall serve for such time and under such conditions as the Council may prescribe. In the absence of the Chairman, or in the event of his incapacity, the Vice Chairman shall act as Chairman.

Term of office.

(d) The term of office of each member of the Council appointed under subsection (a)(1) shall be four years except that any such member appointed to fill a vacancy occurring prior to the expiration of the term for which his predecessor was appointed shall be appointed for the remainder of such term. No person shall be appointed a member of the Council under subsection (a)(1) more than twice. Terms of the members appointed under subsection (a)(1) shall be staggered so as to establish a rotating membership according to such method as the Board may devise.

Travel expenses.

(e)(1) The members of the Council other than those appointed under subsection (a)(1) shall receive no pay for their services as members of the Council, but shall be allowed necessary travel expenses (or, in the alternative, mileage for use of privately owned vehicles and a per diem in lieu of subsistence at not to exceed the rate prescribed in sections 5702 and 5704 of title 5, United States Code), and other necessary expenses incurred by them in the performance of duties vested in the Council, without regard to the provisions of subchapter 1 of chapter 57 and section 5731 of title 5, United States Code, and regulations promulgated thereunder.

80 Stat. 498;
83 Stat. 190.
5 USC 5701.

Compensation.

(2) The members of the Council appointed under subsection (a)(1) shall receive compensation for each day engaged in the actual performance of duties vested in the Council at rates of pay not in excess of the daily equivalent of the highest rate of basic pay set forth in the General Schedule of section 5332(a) of title 5, United States Code, and in addition shall be reimbursed for travel, subsistence, and other necessary expenses in the manner provided for other members of the Council under paragraph (1) of this subsection.

UTILIZATION OF THE LIBRARY OF CONGRESS

SEC. 8. (a) To carry out the objectives of this Act, the Librarian of Congress is authorized to make available to the Office such services and assistance of the Congressional Research Service as may be appropriate and feasible.

(b) Such services and assistance made available to the Office shall include, but not be limited to, all of the services and assistance which the Congressional Research Service is otherwise authorized to provide to the Congress.

(c) Nothing in this section shall alter or modify any services or responsibilities, other than those performed for the Office, which the Congressional Research Service under law performs for or on behalf of the Congress. The Librarian is, however, authorized to establish within the Congressional Research Service such additional divisions, groups, or other organizational entities as may be necessary to carry out the purpose of this Act.

(d) Services and assistance made available to the Office by the Congressional Research Service in accordance with this section may be provided with or without reimbursement from funds of the Office, as agreed upon by the Board and the Librarian of Congress.

UTILIZATION OF THE GENERAL ACCOUNTING OFFICE

SEC. 9. (a) Financial and administrative services (including those related to budgeting, accounting, financial reporting, personnel, and procurement) and such other services as may be appropriate shall be provided the Office by the General Accounting Office.

(b) Such services and assistance to the Office shall include, but not be limited to, all of the services and assistance which the General Accounting Office is otherwise authorized to provide to the Congress.

(c) Nothing in this section shall alter or modify any services or responsibilities, other than those performed for the Office, which the General Accounting Office under law performs for or on behalf of the Congress.

(d) Services and assistance made available to the Office by the General Accounting Office in accordance with this section may be provided with or without reimbursement from funds of the Office, as agreed upon by the Board and the Comptroller General.

COORDINATION WITH THE NATIONAL SCIENCE FOUNDATION

SEC. 10. (a) The Office shall maintain a continuing liaison with the National Science Foundation with respect to—

(1) grants and contracts formulated or activated by the Foundation which are for purposes of technology assessment; and

(2) the promotion of coordination in areas of technology assessment, and the avoidance of unnecessary duplication or overlapping of research activities in the development of technology assessment techniques and programs.

Scientific programs, financing.
82 Stat. 360.

(b) Section 3(b) of the National Science Foundation Act of 1950, as amended (42 U.S.C. 1862(b)), is amended to read as follows:

"(b) The Foundation is authorized to initiate and support specific scientific activities in connection with matters relating to international cooperation, national security, and the effects of scientific applications upon society by making contracts or other arrangements (including grants, loans, and other forms of assistance) for the conduct of such activities. When initiated or supported pursuant to requests made by any other Federal department or agency, including the Office of Technology Assessment, such activities shall be financed whenever feasible from funds transferred to the Foundation by the requesting official as provided in section 14(g), and any such activities shall be unclassified and shall be identified by the Foundation as being undertaken at the request of the appropriate official."

64 Stat. 156;
82 Stat. 365.
42 USC 1873.

ANNUAL REPORT

SEC. 11. The Office shall submit to the Congress an annual report which shall include, but not be limited to, an evaluation of technology assessment techniques and identification, insofar as may be feasible, of technological areas and programs requiring future analysis. Such report shall be submitted not later than March 15 of each year.

APPROPRIATIONS

SEC. 12. (a) To enable the Office to carry out its powers and duties, there is hereby authorized to be appropriated to the Office, out of any money in the Treasury not otherwise appropriated, not to exceed $5,000,000 in the aggregate for the two fiscal years ending June 30, 1973, and June 30, 1974, and thereafter such sums as may be necessary.

(b) Appropriations made pursuant to the authority provided in subsection (a) shall remain available for obligation, for expenditure, or for obligation and expenditure for such period or periods as may be specified in the Act making such appropriations.

Approved October 13, 1972.

LEGISLATIVE HISTORY:

HOUSE REPORTS: No. 92-469 (Comm. on Science and Astronautics) and
No. 92-1436 (Comm. of Conference).
SENATE REPORT No. 92-1123 (Comm. on Rules and Administration).
CONGRESSIONAL RECORD, Vol. 118 (1972):
Feb. 8, considered and passed House.
Sept.14, considered and passed Senate, amended.
Sept.22, Senate agreed to conference report.
Oct. 4, House agreed to conference report.

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MARCH 198

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